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CHEMICAL
MANUFACTURERS
ASSOCIATION

2501 M Street, NW 202-887-1100
Washington, D.C. 20037 Telex 89617 (CMA WSH)

**BEFORE THE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**

**COMMENTS OF THE
CHEMICAL MANUFACTURERS ASSOCIATION
ON PROPOSED HAZARDOUS ORGANIC NESHA
APPENDICES**

)	
National Emission Standards for)	
Hazardous Air Pollutants for Source)	Docket Nos. A-90-19
Categories; Organic Hazardous Air)	A-90-20
Pollutants from the Synthetic Organic)	A-90-21
Chemical Manufacturing Industry and)	A-90-22
Seven Other Processes)	A-90-23
57 Fed. Reg. 62608 (Dec. 31, 1992))	
)	

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April 19, 1993

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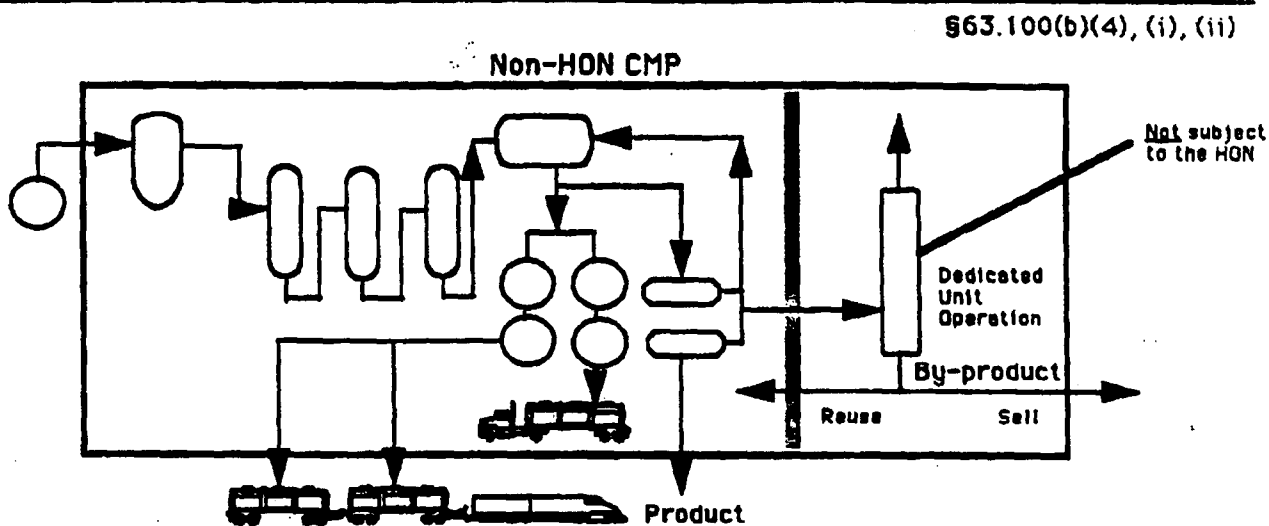
APPENDIX A

APPENDIX A

APPLICABILITY FOR UNIT OPERATIONS

Shared Unit Operations, Example 1

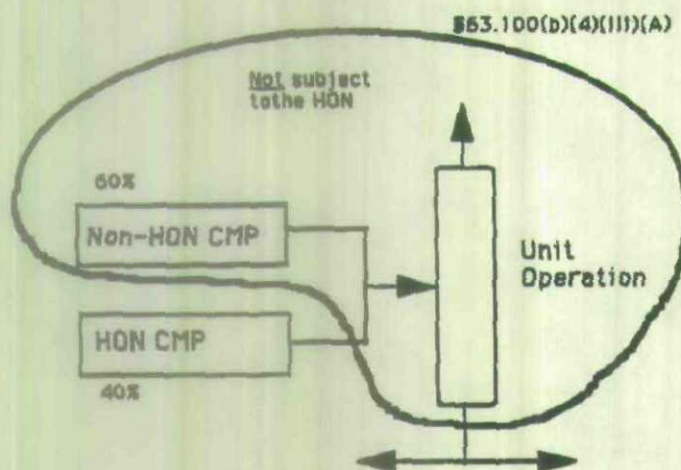
This example represents a unit operation that is dedicated to a non-HON chemical manufacturing process. Even if the unit operation purifies a by-product, co-product or isolated intermediate stream that is listed in section 63.105 or section 63.184, the unit operation and the non-HON process are not subject to this regulation. This determination would not change if the unit operation was on the front-end or in the middle of the process, as long as it is integral to the chemical manufacturing process.



If the same diagram depicted a HON process, then the integral unit operation would be subject to the conditions of the rule.

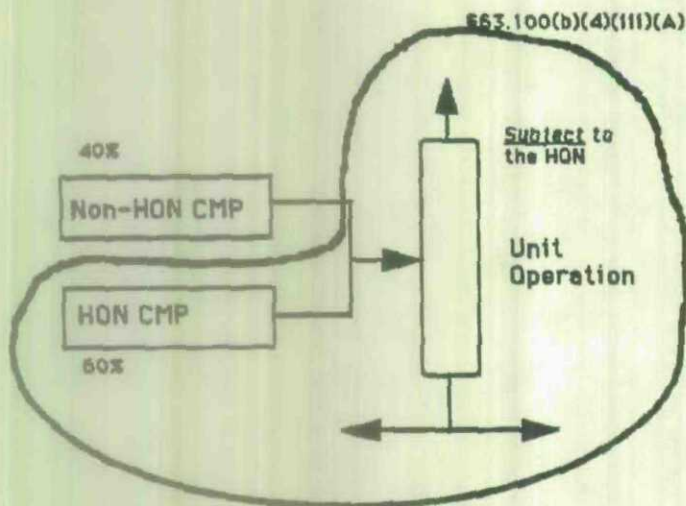
Shared Unit Operations. Example 2

This unit operation receives its predominant input from a non-HON chemical manufacturing process at the same plant site. In this situation, the unit operation will be associated with the non-HON process even though a portion of its input is from a HON chemical manufacturing process.



Shared Unit Operations. Example 3

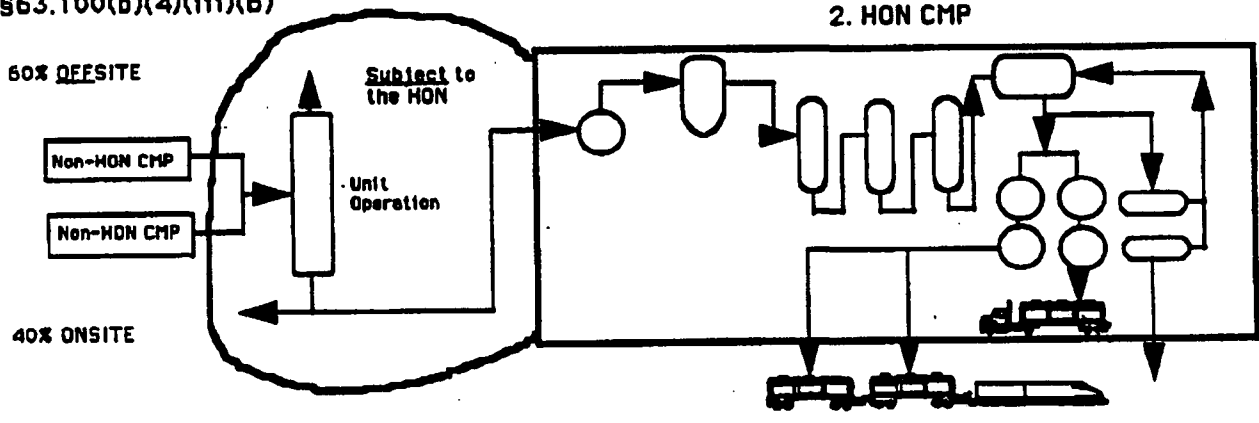
In this situation, the predominant input to the unit operation is from a HON chemical manufacturing process at the same plant site. The unit operation will be associated with the regulated HON process since the predominant need for the unit is due to the input from the HON process.



Shared Unit Operations. Example 4

In this situation, the predominant input to the unit operation is from off-site, so the chemical manufacturing process (in this case a HON process) that receives the greatest amount of product from the unit operation would determine the applicability for the unit operation.

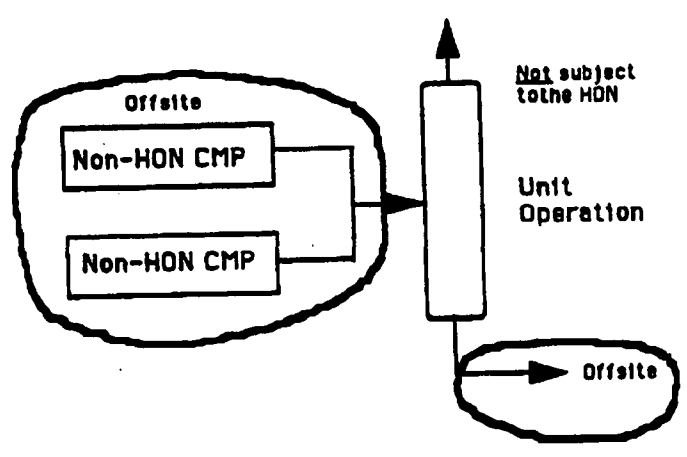
§63.100(b)(4)(iii)(B)



Shared Unit Operations. Example 5

In this case, both inputs to the unit operation that are not located at the same plant site and the unit operation does not send its product to a chemical manufacturing process at the same plant site. This type of unit operation would be regulated, if appropriate, as a separate source category.

§63.100(b)(4)(ii)



APPENDIX B

APPENDIX B

TOTAL AIR RELEASES FOR SICs 2865 & 2869

12:39 FRIDAY, DECEMBER 4, 1992

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DBS	PANAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
1		WI	FURNITURE RESTORATION PRODUCTS LTD	0	0	0
2		PR	HANUEL DEL VALLE INC.	0	1145	260
3		RI	CAL CHEMICAL CORP.	0	0	5
4		RI	DYTEX CHEMICAL CO. INC.	3317	0	0
5		RI	EASTERN COLOR & CHEMICAL CO.	3350	4000	3000
6		CT	HAMPFORD RESEARCH INC.	80286	75600	50694
7		NJ	RYCOLINE PRODUCTS INC.	1000	0	520
8		NJ	DELEET MERCHANDISING CORP.	1090	0	1530
9		NJ	LIPD CHEMICALS INC.	0	0	0
10		NJ	J. H. PRODUCTS INC.	10	10	15
11		NY	TWIN LAKE CHEMICAL INC.	1000	1250	1230
12		NY	UANCHEN INC.	1147	963	151
13		NY	NIACEI CORP.	676850	416000	518755
14		WV	AC WEST VIRGINIA POLYOLS CO. INSTITUTE W.V. PLANT	0	0	161619
15		WV	AC WEST VIRGINIA POLYOL CO.	0	0	69408
16		NC	APOLLO CHEMICAL CORP.	750	750	750
17		NC	AJIMOTO USA INC.	1910	1910	920
18		NC	SYNTHRON INC.	500	1000	34500
19		NC	ALCHERY SOUTH LTD	0	8000	8000
20		CA	MANUFACTURER'S CHEMICAL & SUPPLY INC.	0	0	0
21		CA	STANDARD ADHESIVE & CHEMICAL CO. INC.	31	30	85
22		CA	WESLEY INDUSTRIES INC.	250	0	0
23		AL	HAYWOOD CO.	4362	0	0
24		TX	CHAPMAN CHEMICAL CO.	0	0	260
25		TX	WESTLAKE MONOMERS CORP.	0	0	501423
26		KY	CHEMTRON CORP.	6695	0	0
27		OH	ROSDS CHEMICALS CO.	250	0	0
28		IL	RYCOLINE PRODUCTS INC.	3500	2500	1500
29		LA	PEARL RIVER POLYMERS INC. PEAR RIVER	0	0	2804
30		LA	RUBICON INC. GEISNAR SITE	566433	469943	953260
31		LA	LE CHEN INC.	0	0	404222
32		LA	COMPLEX CHEMICALS CO. INC.	500	500	500
33		TX	P CHEN INC.	16200	2000	1500
34		TX	BLENTCH CORP.	0	5250	170
35		TX	SEA LION CHEMICAL	0	0	6255
36		CA	FLASK CHEMICAL CORP.	2000	0	0
37		CA	RYCOLINE PRODUCTS INC.	1000	0	1000
38		OR	MOLECULAR PROBES INC.	0	0	500
39		NC	CATAMBA-CHARLAB INC.	0	500	310678
40		AR	A. E. STALEY MFG. CO.	476916	300511	7120
41		NA	A. W. CHESTERTON CO.	6927	16280	700720
42		NJ	ARSYNCO INC.	29500	30500	0
43		NY	ROEHR CHEMICALS INC.	2819	0	0
44		GA	AFF INC. CHEMICAL DIV.	0	0	0
45		NJ	AIR PRODUCTS & CHEMICALS INC.	3900	9500	3900
46		SC	AIR PRODUCTS & CHEMICALS INC.	50200	52800	37800
47		FL	AIR PRODUCTS & CHEMICALS INC.	238000	235900	0
48		FL	AIR PRODUCTS & CHEMICALS INC.	0	0	282069
49		KY	AIR PRODUCTS & CHEMICALS INC.	6040800	4233400	3821758
50		KS	AIR PRODUCTS & CHEMICALS INC.	18000	16100	15110
51		TX	AIR PRODUCTS & CHEMICALS INC.	4300	4384	2314
52		KS	AIRSOOL CO. INC.	750	250	500
53		NJ	AKZO CHEMICALS INC.	500	500	500
54		NJ	AKZO CHEMICALS INC.	35950	21450	4710
55		NJ	AKZO CHEMICALS INC.	750	1359	4445

TOTAL AIR RELEASES FOR SICs 2865 & 2869

12:39 FRIDAY, DECEMBER 4, 1992 2

OBS	PARNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
56	AKZO CHEMICALS INC.	NY	AKZO CHEMICALS INC. CHEMICAL DIV.	5263	3973	5870
57	AKZO CHEMICALS INC.	DE	AKZO CHEMICALS INC.	41300	45000	36400
58	AKZO CHEMICALS INC.	WV	AKZO CHEMICALS INC.	8660	0	127013
59	AKZO CHEMICALS INC.	AL	AKZO CHEMICALS INC.	1729000	1701000	859250
60	AKZO CHEMICALS INC.	MI	AKZO CHEMICALS INC.	10	3967	4251
61	AKZO CHEMICALS INC.	IL	AKZO CHEMICALS INC.	385050	361700	264310
62	AKZO CHEMICALS INC.	IL	AKZO CHEMICALS INC.	357050	338050	483354
63	AKZO CHEMICALS INC.	IL	AKZO CHEMICALS INC. MC COOK RESEARCH CENTER	0	2000	775
64	AKZO CHEMICALS INC.	TX	AKZO CHEMICALS INC.	230	10650	1500
65	ALLCO CHEMICAL CORP.	KS	ALLCO CHEMICAL CORP.	1500	11700	6500
66	ALLEGHENY CHEMICAL CORP.	PA	ALLEGHENY CHEMICAL CORP.	9828	0	0
67	ALLIED COLLOIDS GROUP PLC	VA	ALLIED COLLOIDS INC.	28638	28517	86609
68	ALLIED-SIGNAL INC.	NJ	ALLIED-SIGNAL INC. ELIZABETH	13353	6397	14129
69	ALLIED-SIGNAL INC.	NY	ALLIED-SIGNAL INC.	0	513	1278
70	ALLIED-SIGNAL INC.	PA	ALLIED-SIGNAL INC.	1458000	1399000	1274005
71	ALLIED-SIGNAL INC.	DE	ALLIED-SIGNAL INC. DELAWARE PLANT	2500	3250	5000
72	ALLIED-SIGNAL INC.	VA	ALLIED-SIGNAL INC. HOPWELL PLANT	257650	257650	544055
73	ALLIED-SIGNAL INC.	AL	ALLIED-SIGNAL INC. FAIRFIELD TAP PLANT	12498	10794	10638
74	ALLIED-SIGNAL INC.	OH	ALLIED-SIGNAL INC.	231800	173690	148110
75	ALLIED-SIGNAL INC.	MI	ALLIED-SIGNAL INC.	33858	31596	30032
76	ALLIED-SIGNAL INC.	IL	ALLIED-SIGNAL INC. DANVILLE WORKS	12300	3000	2733
77	ALLIED-SIGNAL INC.	LA	ALLIED-SIGNAL INC. BATON ROUGE SOUTH	527840	338868	480431
78	ALLIED-SIGNAL INC.	CA	ALLIED-SIGNAL INC.	19731	14164	7245
79	ALTERNATE ENERGY RESOURCES INC.	GA	ALTERNATE ENERGY RESOURCES INC.	3204	221	0
80	ANAX INC.	IL	CLINAX PERFORMANCE MATERIALS CORP.	500	0	0
81	AMERICAN BIO-SYNTHETICS CORP.	MI	AMERICAN BIO-SYNTHETICS CORP.	71480	39551	73014
82	AMERICAN CHEMICAL SERVICE INC.	IN	AMERICAN CHEMICAL SERVICE INC.	21595	18146	8007
83	AMERICAN CYANAMID COMPANY	PR	CYANAMID AGRICULTURAL DE PR INC.			91300
84	AMERICAN CYANAMID COMPANY	NJ	AMERICAN CYANAMID CO. WARNERS PLANT	8675	7877	6766
85	AMERICAN CYANAMID COMPANY	NJ	AMERICAN CYANAMID CO.	4579	2240	1465
86	AMERICAN CYANAMID COMPANY	NJ	AMERICAN CYANAMID CO. LEDERLE LABORATORIES DIV.	9765	12382	66369
87	AMERICAN CYANAMID COMPANY	WV	AMERICAN CYANAMID CO.	1337730	407780	411155
88	AMERICAN CYANAMID COMPANY	NC	AMERICAN CYANAMID CO.	30957	22397	38564
89	AMERICAN CYANAMID COMPANY	OH	AMERICAN CYANAMID CO.	177410	135385	154054
90	AMERICAN CYANAMID COMPANY	MI	AMERICAN CYANAMID CO.	0	0	74200
91	AMERICAN CYANAMID COMPANY	LA	AMERICAN CYANAMID CO. FORTIER PLANT	296750	249100	236855
92	AMERSHAM CORP.	IL	AMERSHAM CORP.	1500	1000	0
93	AMOCO CORP.	SC	AMOCO CHEMICAL CO. COOPER RIVER PLANT	1530000	2062100	1281600
94	AMOCO CORP.	AL	AMOCO CHEMICAL CO.	2159750	1807670	1972820
95	AMOCO CORP.	MS	AMOCO PETROLEUM ADDITIVES CO.	2249659	2766182	2312496
96	AMOCO CORP.	OH	AMOCO PERFORMANCE PRODUCTS INC	1848143	1857037	2278010
97	AMOCO CORP.	IN	AMOCO CHEMICAL CO.	4120	6319	3857
98	AMOCO CORP.	IL	AMOCO CHEMICAL CO.	314350	307750	372650
99	AMOCO CORP.	IL	AMOCO RESEARCH CENTER	22310	22505	23540
100	AMOCO CORP.	IL	AMOCO PETROLEUM ADDITIVES CO.	67190	39330	34610
101	AMOCO CORP.	TX	AMOCO CHEMICAL CO. CHOCOLATE BAYOU PLANT	713147	873388	945585
102	AMOCO CORP.	TX	AMOCO CHEMICAL CO. TEXAS CITY PLANT A	0	7128	9296
103	AMOCO CORP.	TX	AMOCO CHEMICAL CO. TEXAS CITY DOCKS	0	149040	122930
104	AMOCO CORP.	TX	AMOCO CHEMICAL CO. TEXAS CITY DOCKS	642088	0	0
105	AMOCO CORP.	TX	AMOCO CHEMICAL CO. TEXAS CITY PLANT B	0	434508	279706
106	ANSPEC CHEMICAL CORP.	NJ	ANSPEC CHEMICAL CORP.	170600	175810	177630
107	ANDERSON DEVELOPMENT CO.	MI	ANDERSON DEVELOPMENT CO.	0	10168	672
108	ANGUS CHEMICAL CO.	LA	ANGUS CHEMICAL CO.	0	0	305730
109	APPLETON PAPERS INC.	MI	EAST SHORE CHEMICAL CO.	0	46677	0
110	APPLIED BIOSYSTEMS	CA	APPLIED BIOSYSTEMS	0	1350	1750

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TOTAL AIR RELEASES FOR SIC 2865 & 2869

DBS	PARKNAME	STATE	FACTNAME	YEAR88	YEAR89	YEAR90
111	AQUALON - A HERCULES INC. CO.	ND	MISSOURI CHEMICAL WORKS	779000	793000	1173000
112	ARCHEN CO.	TX	ARCHEN CO.	7649	0	0
113	ARGUS CO.	KY	ARGUS CO.	8037	0	0
114	ARISTECH CHEMICAL CORP.	PA	ARISTECH CHEMICAL CORP. TARGEM PLANT	184652	125006	147044
115	ARISTECH CHEMICAL CORP.	PA	ARISTECH CHEMICAL CORP.	75950	140878	152535
116	ARISTECH CHEMICAL CORP.	KY	ARISTECH CHEMICAL CORP.	158250	108250	56250
117	ARISTECH CHEMICAL CORP.	OH	ARISTECH CHEMICAL CORP.	1226623	1165430	1010200
118	ARISTECH CHEMICAL CORP.	TX	ARISTECH CHEMICAL CORP. PASADENA	0	41450	43870
119	ARISTECH CHEMICAL CORP.	TX	ARISTECH CHEMICAL CORP. PASADENA	46370	0	0
120	ARROW ENGINEERING INC.	CA	ARROW ENGINEERING INC.	500	500	510
121	ASHLAND OIL INC.	WV	ASHLAND CHEMICAL INC.	73800	20967	13859
122	ASHLAND OIL INC.	OH	ASHLAND CHEMICAL INC.	6236	7082	0
123	ASHLAND OIL INC.	OH	ASHLAND CHEMICAL INC.	51509	53419	0
124	ASHLAND OIL INC.	OH	ASHLAND CHEMICAL INC.	4450	8750	6160
125	ASHLAND OIL INC.	LA	SOUTH POINT ETHANOL SOUTH POINT ETHANOL	19093	1916130	0
126	ASHLAND OIL INC.	LA	ASHLAND CHEMICAL INC.	0	0	273000
127	ATLANTIC RICHFIELD CO.	PA	ARCO CHEMICAL CO.	0	206061	212610
128	ATLANTIC RICHFIELD CO.	TX	ARCO CHEMICAL CO. BAYPORT DIV.	102257	324040	501910
129	ATLANTIC RICHFIELD CO.	TX	ARCO CHEMICAL CO.	974645	905290	324870
130	B. F. GOODRICH CO.	IL	BF GOODRICH CO.	83327	137170	0
131	BAC PRODUCTS INC.	GA	BAC PRODUCTS INC.	0	250	0
132	BALCHEN CORP.	SC	BALCHEN CORP.	19603	1539	261
133	BASF CORP.	NJ	BASF CORP.	3511	3823	5900
134	BASF CORP.	NJ	BASF CORP.	0	6050	6405
135	BASF CORP.	HJ	FRITZSCHE DODGE & DUNCOTT UNIT OF BASF K & F CORP.	11700	12117	2604
136	BASF CORP.	NY	BASF CORP. COATINGS & COLORANTS DIV.	192231	122825	52147
137	BASF CORP.	WV	BASF CORP. CHEMICALS DIV.	0	0	49901
138	BASF CORP.	NC	BASF CORP.	14050	14087	14183
139	BASF CORP.	NI	CHEMICAL ENG. R & D	188500	0	717
140	BASF CORP.	NI	BASF CORP. POLYMERS PLANT	0	0	94580
141	BASF CORP.	NI	BASF CORP. COATINGS & COLORANTS DIV.	55	174	66
142	BASF CORP.	LA	BASF CORP.	778465	664524	700167
143	BASF CORP.	TX	BASF CORP.	645177	358700	182555
144	BAXTER HEALTHCARE CORP.	TX	BAXTER HEALTHCARE CORP. BURDICK & JACKSON DIV.	6476	2050	12345
145	BAYER A.G.	NI	RHEIN CHEMIE CORP.	0	1	0
146	BAYER A.G.	HJ	MOBAY CORP.	302349	1032753	1084836
147	BAYER A.G.	WV	MOBAY CORP.	130736	50274	111984
148	BAYER A.G.	SC	HAARMANN & REINER CORP.	211504	188821	116797
149	BAYER A.G.	SC	MOBAY CORP. BUSHY PARK PLANT	500	500	32
150	BAYER A.G.	IN	MOBAY CORP.	5300	0	0
151	BAYER A.G.	TX	MOBAY CORP.	0	0	238662
152	BEDDOUKIAN RESEARCH INC.	CT	BEDDOUKIAN RESEARCH INC.	127	11	14
153	BELL CHEMICAL CO.	IL	BELL CHEMICAL CO.	106469	0	0
154	BF GOODRICH CO.	KY	BF GOODRICH CO. BFG INTERMEDIATES CO. INC.	405213	0	87024
155	BF GOODRICH CO.	OH	BF GOODRICH AVON LAKE FACILITIES	0	0	6400
156	BF GOODRICH CO.	OH	BF GOODRICH CO. AKRON CHEMICAL PLANT	573700	531145	439440
157	BF GOODRICH CO.	TX	BF GOODRICH CO. LA PORTE PLANT	60990	78440	64040
158	BIO RAD LABORATORIES INC.	CA	BIO-INTERMEDIATES INC. CHEMICAL DIV.	0	54150	46183
159	BIOCHEMICAL LABORATORIES INC.	CA	SPECTRUM CHEMICAL MFG. CORP.	0	1500	250
160	BURDEN CHEMICAL & PLASTICS	LA	BURDEN CHEMICAL & PLASTICS	481874	517489	537334
161	BURDEN INC.	NC	BURDEN INC. PACKAGING & INDUSTRIAL PRODUCTS	26590	11050	35200
162	BURDEN INC.	AL	BURDEN PACKAGING & INDUSTRIAL PRODUCTS	30381	21314	14370
163	BURDEN INC.	KY	BURDEN PACKAGING & INDUSTRIAL PRODUCTS	96510	57450	51590
164	BURDEN INC.	WI	BURDEN PACKAGING & INDUSTRIAL PRODUCTS	0	0	21910
165	BURDEN INC.	MT	BURDEN INC. PACKAGING & INDUSTRIAL PRDS.	0	0	15900

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OBS	PARKNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
166	BURDEN INC.	TX	BURDEN INC. PACKAGING & INDUSTRIAL PRODS.	43600	27850	15400
167	BURDEN INC.	CA	BURDEN INC. PKG. & INDST. PRODUCTS	13560	5154	5905
168	BURDEN INC.	OR	BURDEN INC. PKG. & INDST. PRODUCTS	36020	30140	25130
169	BURDEN INC.	OR	BURDEN PACKAGING & INDUSTRIAL PRODUCTS	0	0	8745
170	BURDEN INC.	WA	BURDEN PACKAGING & INDUSTRIAL PRODUCTS	17640	10020	6605
171	BOULDER SCIENTIFIC CO.	CO	BOULDER SCIENTIFIC CO.	0	0	1830
172	BP AMERICA	OH	BP CHEMICALS INC.	620430	399250	280745
173	BP AMERICA	TX	BP CHEMICALS GREEN LAKE	81000	46768	41719
174	BROUSSARD CHEMICAL CO.	LA	BROUSSARD CHEMICAL CO.	500	820	0
175	BROUSSARD CHEMICAL CO.	LA	ANTIFREEZE INC.	0	0	820
176	BTL SPECIALTY RESINS CORP	AR	BTL SPECIALTY RESINS CORP.	0	0	136240
177	BTL SPECIALTY RESINS CORP	TX	BTL SPECIALTY RESINS CORP.	81265	28930	30910
178	BURKE CHEMICALS	CA	BURKE CHEMICALS	250	300	255
179	BY-CHEN CORP	ND	BY-CHEN CORP.	0	1000	16196
180	C. P. HALL CO.	TX	C. P. HALL CO.	250	500	500
181	C. P. HALL CO.	OH	C. P. HALL CO.	750	500	10
182	C. P. HALL CO.	IL	C. P. HALL CO.	71756	80230	14500
183	C. P. HALL CO.	IL	C. P. HALL CO.	1000	1250	1000
184	C. P. HALL CO.	CA	C. P. HALL CO.	300	300	300
185	CANREX CORP.	CT	HUMPHREY CHEMICAL CO.	2000	1000	1000
186	CANREX CORP.	NJ	COSAN CHEMICAL CORP.	1000	1000	739
187	CANREX CORP.	NY	NEPERA INC.	9773	8978	9612
188	CANREX CORP.	PA	HEIGD CHEMICALS INC.	108378	58250	33750
189	CAPITAL RESIN CORP.	OH	CAPITAL RESIN CORP.	0	0	15325
190	CARDINAL STABILIZERS INC.	SC	CARDINAL STABILIZERS INC.	250	250	0
191	CHEN LAB PRODUCTS INC.	CA	CHEN LAB PRODUCTS INC.	0	0	10
192	CHEN SUPPLY CO.	ND	CHEN SUPPLY CO.	0	3250	1760
193	CHENEDESIGN CORP.	MA	CHENEDESIGN CORP.	19739	47761	18666
194	CHENEDESIGN CORP.	WI	SPECIALTYCHEN PRODUCTS CORP.	58707	73600	184833
195	CHEMICAL EXCHANGE INDUSTRIES I	TX	OXIO INC.	230	230	44380
196	CHEMICAL EXCHANGE INDUSTRIES I	TX	ADVANCED AROMATICS INC.	72239	93910	124979
197	CHEMICAL EXCHANGE INDUSTRIES I	TX	AMERICAN TEXMARK INC. DBA TEXMARK	0	0	15890
198	CHEMICAL EXCHANGE INDUSTRIES I	OH	CHEMICAL SOLVENTS INC. DENISON FACILITY	0	0	9692
199	CHEMICAL SOLVENTS INC.	OH	CHEMICAL SOLVENTS INC. JENNINGS FACILITY	0	0	8028
200	CHEMICAL SOLVENTS INC.	OH	CHEMICAL SOLVENTS INC.	0	0	0
201	CHEMTRONICS INC.	NY	CHEMTRONICS INC.	900	0	0
202	CHEVRON CORP.	NS	CHEVRON USA INC. PASCAGOULA REFINERY	1097030	1277130	1322800
203	CHEVRON CORP.	LA	CHEVRON CHEMICAL CO. OAK POINT PLANT	10272	12084	0
204	CHEVRON CORP.	LA	CHEVRON CHEMICAL CO.	164600	152000	151158
205	CHEVRON CORP.	TX	CHEVRON CHEMICAL CO.	24703	21703	19492
206	CHIEF CHEMICAL & SUPPLY INC.	OK	CHIEF CHEMICAL & SUPPLY INC.	49596	0	0
207	CIBA-GEIGY CORP.	NJ	CIBA-GEIGY CORP. TONS RIVER PLANT	130577	182428	106196
208	CIBA-GEIGY CORP.	DE	CIBA-GEIGY CORP.	126435	131800	1161979
209	CIBA-GEIGY CORP.	AL	CIBA-GEIGY CORP. MCINTOSH PLANT	616930	1761300	2271410
210	CIBA-GEIGY CORP.	LA	CIBA-GEIGY CORP.	1695600	369100	593526
211	CINCINNATI MILACRON INC.	OH	CINCINNATI MILACRON INC.	31980	54201	39641
212	CITGO PETROLEUM CORP.	LA	CITGO PETROLEUM CORP.	0	0	1287088
213	COLGATE-PALMOLIVE CO.	TX	CPL INDUSTRIES	17655	0	0
214	CONNERCE INDUSTRIAL CHEMICALS	WI	CONNERCE INDUSTRIAL CHEMICALS INC.	7000	6500	8255
215	CONNECTICUT PRODUCTS FINISHING	CT	CONNECTICUT PRODUCTS FINISHING CORP.	21127	0	0
216	CONNECTICUT PRODUCTS FINISHING	CT	CONNECTICUT PRODUCTS FINISHING CORP.	28864	0	0
217	CONTINENTAL CHEMICAL CO.	NJ	CONTINENTAL CHEMICAL CO.	1250	1000	750
218	COOKSON AMERICA INC.	CT	SYNTHETIC PRODUCTS CO.	730	301	10
219	COOKSON AMERICA INC.	CT	SYNTHETIC PRODUCTS CO.	500	251	255
220	COOKSON AMERICA INC.	NJ	SYNTHETIC PRODUCTS INC.	0	137	504
	COOKSON AMERICA INC.	GA	ALPHA METALS INC.	1500	1000	0

DBS	PARKNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
221	CPS CHEMICAL CO.	NJ	CPS CHEMICAL CO. INC.	17050	15170	15405
222	CPS CHEMICAL CO.	AR	CPS CHEMICAL CO. INC. CPS CHEMICAL CO. OF ARKANSAS	19200	30558	44558
223	CROMPTON & KNOWLES CORP.	NJ	CROMPTON & KNOWLES CORP.	200	283	642
224	CROMPTON & KNOWLES CORP.	NJ	CROMPTON & KNOWLES CORP.	1250	3000	28
225	CROMPTON & KNOWLES CORP.	PA	CROMPTON & KNOWLES CORP.	55	203	77
226	CROMPTON & KNOWLES CORP.	PA	CROMPTON & KNOWLES CORP.	0	0	0
227	CROMPTON & KNOWLES CORP.	NC	CROMPTON & KNOWLES CORP.	1265	766	1076
228	CROWN METRO INC.	SC	CROWN METRO INC.	7250	7000	6755
229	DAICOLOR POPE INC.	NJ	DAICOLOR POPE INC.	4	9	10
230	DAYTON SOFTWATER CORP. INC.	OH	ENVIRONMENTAL PROCESSING INC.	1031	0	0
231	DEEPWATER INC.	CA	DEEPWATER IODIDES INC.	0	250	250
232	DEERE & CO.	WI	JOHN DEERE HORIZON WORKS	18700	10550	21105
233	DEGUSSA CORP.	AL	DEGUSSA CORP. ALABAMA GROUP	83181	62263	76630
234	DELTA CHEMICAL CORP.	ND	DELTA CHEMICAL CORP.	250	23	23
235	DELTA FOREMOST CHEMICAL CORP.	TX	DELTA FOREMOST CHEMICAL CORP.	1725	1690	1632
236	DELTECH CORP	LA	DELTECH CORP.	25394	22011	45381
237	DESOTO INC.	LA	DESOTO INC. SPECIALTIES DIV.	33883	33140	0
238	DEXTER CORP.	NH	DEXTER CORP. ELECTRONIC MATERIALS DIV.	0	0	600
239	DEXTER CORP.	CA	DEXTER CORP. ELECTRONIC MATERIALS DIV.	0	41500	58000
240	DIAZ CHEMICAL CORP.	NY	DIAZ CHEMICAL CORP.	60650	35930	22000
241	DIC AMERICAS INC.	NJ	SUN CHEMICAL CORP.	79000	61000	48330
242	DIC AMERICAS INC.	NY	SUN CHEMICAL CORP.	0	0	0
243	DIC AMERICAS INC.	OH	SUN CHEMICAL CORP.	0	500	2750
244	DIC AMERICAS INC.	NI	SUN CHEMICAL CORP.	0	0	0
245	DIXIE CHEMICAL CO. INC.	TX	DIXIE PETRO-CHEM INC.	0	0	0
246	DIXIE CHEMICAL CO. INC.	TX	DIXIE CHEMICAL CO. INC.	52753	78957	115480
247	DIXIE FURNITURE CO. INC.	SC	ABCO INDUSTRIES LTD.	5500	6300	8000
248	DODGE CHEMICAL CO.	NA	DODGE CHEMICAL CO.	1000	1500	1500
249	DOW CHEMICAL CO.	NI	DOW CHEMICAL CO. USA MICHIGAN DIV.	1765537	1730291	1404875
250	DOW CHEMICAL CO.	LA	DOW CHEMICAL CO. GRAND BAYOU PLANT	0	0	36273
251	DOW CHEMICAL CO.	LA	DOW CHEMICAL CO. LOUISIANA DIV.	1442119	1269506	739352
252	DOW CHEMICAL CO.	TX	DOW CHEMICAL CO.	818670	1073830	925203
253	DOW CHEMICAL CO.	NY	HUGUENOT SITE WICKHEM	198	0	0
254	DOW CORNING CORP	KY	DOW CORNING CORP.	741430	779200	444000
255	DOW CORNING CORP	NI	DOW CORNING CORP.	525692	600603	773380
256	DU PONT	NC	DU PONT CAPE FEAR PLANT	3884111	5967210	0
257	DU PONT	TX	DU PONT OLD HICKORY PLANT	1445208	2913350	0
258	DU PONT	TX	DU PONT MEMPHIS PLANT	1377000	1508500	0
259	DU PONT	KY	DU PONT LOUISVILLE WORKS	677340	635870	0
260	DU PONT	LA	DU PONT PONTCHARTRAIN WORKS	352188	273597	0
261	DX SYSTEMS CO	TX	OPC INDUSTRIES INC.	5877	5000	0
262	E. I. DU PONT DE NEMOURS INC.	NJ	DU PONT GRASSELLI PLANT	47760	0	0
263	E. I. DU PONT DE NEMOURS INC.	NJ	DU PONT CHANGERS WORKS CHANGERS WORKS	150849	272778	204350
264	E. I. DU PONT DE NEMOURS INC.	NY	DU PONT NIAGARA FALLS PLANT	13300	0	12452
265	E. I. DU PONT DE NEMOURS INC.	WV	DU PONT BELLE PLANT BELLE PLANT	723327	795086	705316
266	E. I. DU PONT DE NEMOURS INC.	NC	DU PONT HEALING SPRINGS PLANT C & P HEALING SPRINGS	58784	40000	55000
267	E. I. DU PONT DE NEMOURS INC.	NC	DU PONT FAYETTEVILLE PLANT FAYETTEVILLE WORKS	9	20977	28975
268	E. I. DU PONT DE NEMOURS INC.	NC	DU PONT CAPE FEAR PLANT	0	0	5384746
269	E. I. DU PONT DE NEMOURS INC.	AL	DU PONT MOBILE PLANT MOBILE PLANT	18023	19128	16858
270	E. I. DU PONT DE NEMOURS INC.	TX	DU PONT OLD HICKORY PLANT	0	0	1033846
271	E. I. DU PONT DE NEMOURS INC.	OH	DU PONT C&P TOLEDO C & P TOLEDO	31313	85488	108600
272	E. I. DU PONT DE NEMOURS INC.	NI	DU PONT MONTAGUE WORKS	42373	53582	28394
273	E. I. DU PONT DE NEMOURS INC.	TX	DU PONT LA PORTE PLANT LA PORTE PLANT	0	0	831644
274	E. I. DU PONT DE NEMOURS INC.	TX	DU PONT SABINE RIVER WORKS SABINE RIVER WORKS	2570699	1645306	1711815
275	E. I. DU PONT DE NEMOURS INC.	TX	DU PONT BEAUMONT WORKS BEAUMONT WORKS	884044	1030180	925440

DBS	PARNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
276	E. I. DU PONT DE NEMOURS INC.	TX	DU PONT VICTORIA SITE	798817	801070	859961
277	E. I. DU PONT DE NEMOURS INC.	TX	DU PONT CORPUS CHRISTI PLANT CORPUS CHRISTI PLANT	2777	2652	2738
278	E. R. CARPENTER CO. INC.	TX	CARPENTER CHEMICAL CO.	81337	28019	50366
279	EASTMAN KODAK CO.	SC	CAROLINA EASTMAN CO.	1467200	1581250	1695800
280	EASTMAN KODAK CO.	TH	TENNESSEE EASTMAN CO.	7929934	5919180	4447644
281	EASTMAN KODAK CO.	AR	ARKANSAS EASTMAN CO.	723633	862737	563816
282	EASTMAN KODAK CO.	TX	TEXAS EASTMAN CO.	2868602	2656196	1811269
283	EASTON INC.	PR	EASTON INC.	0	0	0
284	ELAN CHEMICAL CO.	NJ	ELAN CHEMICAL CO.	2250	2750	3780
285	EN INDUSTRIES INC.	OH	EN SCIENCE	22020	18044	8953
286	EMCO CHEMICAL DISTRIBUTORS INC	IL	EMCO CHEMICAL DISTRIBUTORS INC.	9870	6925	9211
287	ETHYL CORP.	SC	ETHYL CORP.	775105	0	550200
288	ETHYL CORP.	IL	ETHYL PETROLEUM ADDITIVES INC.	42489	35000	30048
289	ETHYL CORP.	LA	ETHYL PROCESS DEVELOPMENT CENTER	48911	53860	93450
290	ETHYL CORP.	AR	ETHYL CORP.	0	0	26200
291	ETHYL CORP.	AR	ETHYL CORP.	311400	186650	270080
292	ETHYL CORP.	TX	ETHYL CORP. HOUSTON PLANT	82067	43600	36003
293	EXXON	NJ	EXXON CHEMICAL CO. DAYTONE CHEMICAL PLANT	68	9537	10349
294	EXXON	NJ	EXXON BAYWAY CHEMICAL PLANT	0	8486	8823
295	EXXON	NJ	EXXON CHEMICAL CO. TOMAH PRODUCTS	2831	630	876
296	EXXON	CA	EXXON CHEMICAL CALLAWAY CHEN. STRANGE PLANT	3841	4711	4786
297	EXXON	WI	EXXON CHEMICAL CO. TOMAH PRODUCTS	3820	1414	24910
298	EXXON	LA	EXXON CHEMICAL CO.	316	250	600
299	EXXON	LA	EXXON CHEMICAL BATON ROUGE CHEMICAL PLANT	0	1487821	1599547
300	EXXON	TX	EXXON CHEMICAL CO. HOUSTON PLANT	53182	55825	67533
301	EXXON	TX	EXXON CHEMICAL CO. BAYTOWN OLEFINS PLANT	180100	182500	346440
302	EXXON	TX	EXXON CHEMICAL AMERICAS BAYTOWN CHEMICAL PLANT	773316	2319147	1800327
303	EXXON CO USA	NJ	BAYWAY CHEMICAL PLANT (BWCP) (50.20)	0	96	0
304	EXXON CO USA	NJ	LINDEN TECHNOLOGY CENTER	0	661	0
305	EXXON CORP.	NJ	EXXON CHEMICAL AMERICAS BAYWAY CHEMICAL PLANT	35426	0	0
306	EXXON CORP.	LA	EXXON CHEMICAL BATON ROUGE CHEMICAL PLANT	1136910	0	0
307	EXXON CORP.	CA	EXXON CHEMICAL CO. BAKERSFIELD BLEND PLANT	1020	0	0
308	FABRICOLOR MANUFACTURING CORP.	NJ	FABRICOLOR MFG. CO.	0	1500	265
309	FAIRMOUNT CHEMICAL CO. INC.	NJ	FAIRMOUNT CHEMICAL CO. INC.	3500	3610	5185
310	FAR RESEARCH INC.	FL	FAR RESEARCH INC.	0	313	0
311	FERRO CORP.	OH	FERRO CORP. BEDFORD CHEMICAL DIV.	128450	32441	39705
312	FERRO CORP.	IN	FERRO CORP. KEIL CHEMICAL DIV.	2750	124250	1845000
313	FERRO CORP.	LA	FERRO CORP. GRANT CHEMICAL DIV.	0	13806	10083
314	FERRO CORP.	LA	FERRO CORP. GRANT CHEMICAL DIV.	29324	0	0
315	FINA OIL & CHEMICAL CO.	LA	COSMAR CO.	190401	279586	314572
316	FIRMENICH INC.	PR	FLOR-QUIN	3750	3750	3750
317	FIRMENICH INC.	NJ	CHEM FLEUR/FIRMENICH	0	500	0
318	FIRMENICH INC.	NJ	CHEM-FLEUR/FIRMENICH INC.	0	500	21696
319	FIRST CHEMICAL CORP	PA	QUALITY CHEMICALS INC.	0	9208	4727
320	FIRST MISSISSIPPI CORP.	PA	QUALITY CHEMICALS INC.	19855	0	0
321	FIRST MISSISSIPPI CORP.	MS	FIRST CHEMICAL CORP.	143948	98265	50515
322	FISHER SCIENTIFIC CO.	NJ	FISHER SCIENTIFIC CO.	3006	0	0
323	FLINT INK CORP.	OH	CDR PIGMENTS	0	0	0
324	FNC CORP.	NJ	FNC CORP.	0	460	0
325	FNC CORP.	NY	FNC CORP. MIDDLEPORT PLANT	3402	0	0
326	FNC CORP.	MO	FNC CORP.	110060	62988	46303
327	FNC CORP.	WV	FNC CORP. INSTITUTE PLANT	0	0	0
328	FNC CORP.	WV	FNC CORP. NITRO PLANT	4738	2329	4108
329	FNC CORP.	NC	LITHIUM CORP. OF AMERICA/FNC LITHIUM DIV.	1335	1881	1489
330	FNC CORP.	TX	FNC CORP. BAYPORT PLANT	2108	1975	0

TOTAL AIR RELEASES FOR SICs 2865 & 2869 12:39 FRIDAY, DECEMBER 4, 1992 7

DBS	PARKANE	DBS	STATE	PACKNAME	YEAR88	YEAR89	YEAR90
331	FORMOSA PLASTICS CORP. USA	331	LA	FORMOSA PLASTICS CORP. LA	296756	203591	59606
332	FOUNDRY SERVICE & SUPPLY CO. I	332	ND	INDUSTRIAL CHEMICAL PRODUCTS	1000	1000	500
333	FRAGRANCE RESOURCES INC.	333	HJ	FRAGRANCE RESOURCES INC.	1712	2144	2488
334	FREEMAN CHEMICAL CORP.	334	TX	FREEMAN CHEMICAL CORP. - CHARDONOL DIV.	1250	1300	753
335	GAF CORP.	335	TX	GAF CHEMICALS CORP.	0	69330	0
336	GAF CORP.	336	TX	ISP TECHNOLOGIES INC.	72830	0	70130
337	GAF CORP.	337	TX	GAF CHEMICALS CORP. SEADRIFT PLANT	15700	15600	23900
338	GALLADE CHEMICAL INC. DBA DRAM	338	CA	GALLADE CHEMICAL INC. DBA ORANGE COUNTY CHEMICAL CO.	0	0	2750
339	GAYLORD CONTAINER CORP.	339	LA	GAYLORD CHEMICAL CORP.	7	8	12
340	GE CO	340	NY	GE CO. PLASTICS	1429196	1132844	866430
341	GE CO	341	NY	GE CO. SILICONE PRODUCTS	371111	398137	132238
342	GE CO	342	WV	GE CO. SPECIALTY CHEMICALS NORTH PLANT	3830	3960	7493
343	GE CO	343	AL	GE PLASTICS-BURKVILLE OPERATION	0	623788	402291
344	GENCORP INC.	344	CA	AERJET-GENERAL CORP.	72942	0	0
345	GENERAL AUTOMATION INC	345	IL	GENERAL AUTOMATION INC.	0	15320	24544
346	GENERAL CHEMICAL CORP	346	DE	GENERAL CHEMICAL CORP. DELAWARE VALLEY WORKS	7363	6590	4575
347	GENERAL CHEMICAL CORP	347	CA	GENERAL CHEMICAL CORP.	3000	3000	3000
348	GENERAL COLOR CO. INC.	348	HJ	GENERAL COLOR CO. INC.	300	0	253
349	GEORGIA GULF CORP.	349	LA	GEORGIA GULF CORP.	348799	471257	353894
350	GEORGIA GULF CORP.	350	TX	GEORGIA GULF CORP.	141224	59277	73477
351	GEORGIA PACIFIC CORP.	351	NC	GEORGIA PACIFIC RESINS INC.	57200	64566	66388
352	GEORGIA PACIFIC CORP.	352	SC	GEORGIA PACIFIC RESINS INC.	491980	494887	460349
353	GEORGIA PACIFIC CORP.	353	SC	GEORGIA-PACIFIC RESINS INC.	0	12000	15624
354	GEORGIA PACIFIC CORP.	354	GA	GEORGIA-PACIFIC RESINS INC.	79215	71310	31400
355	GEORGIA PACIFIC CORP.	355	NS	GEORGIA-PACIFIC RESINS INC.	0	311727	41814
356	GEORGIA PACIFIC CORP.	356	NS	GEORGIA-PACIFIC RESINS INC.	366775	0	0
357	GEORGIA PACIFIC CORP.	357	OH	GEORGIA-PACIFIC RESINS INC.	228680	181525	131691
358	GEORGIA PACIFIC CORP.	358	AR	GEORGIA-PACIFIC RESINS INC. PLYWOOD	494263	453061	458713
359	GEORGIA PACIFIC CORP.	359	TX	GEORGIA-PACIFIC RESINS INC.	25970	42783	49524
360	GEORGIA PACIFIC CORP.	360	OR	GEORGIA-PACIFIC RESINS INC.	0	68240	660780
361	GEORGIA PACIFIC CORP.	361	HJ	GEORGIA-PACIFIC RESINS INC.	71250	60250	53827
362	GNI GROUP INC.	362	TX	GIVAUDAN CORP.	0	0	2000
363	GOODYEAR TIRE & RUBBER CO.	363	TX	CHEMICAL RESOURCE PROCESSING	832251	0	0
364	GOODYEAR TIRE & RUBBER CO.	364	TX	GOODYEAR DAYPORT CHEMICAL PLANT	432150	280756	90023
365	GOODYEAR TIRE & RUBBER CO.	365	NY	GOODYEAR TIRE & RUBBER CO. BEAUMONT CHEMICAL PLANT	341170	96300	83274
366	GRANITEVILLE CO.	366	SC	GOODYEAR TIRE & RUBBER CO.	3000	0	0
367	GREAT LAKES CHEMICAL CORP	367	FL	C. H. PATRICK & CO. INC.	3000	3250	1906
368	GREAT LAKES CHEMICAL CORP	368	TX	GREAT LAKES CHEMICAL CORP.	61691	300	300
369	GREAT LAKES CHEMICAL CORP	369	TX	GREAT LAKES CHEMICAL CORP.	63750	36963	42221
370	GREAT LAKES CHEMICAL CORP	370	IN	GREAT LAKES CHEMICAL CORP.	3121	63760	66760
371	GREAT LAKES CHEMICAL CORP	371	NE	GREAT LAKES CHEMICAL CORP.	0	1950	2850
372	GREAT LAKES CHEMICAL CORP	372	AR	GREAT LAKES CHEMICAL CORP.	85475	9437	7949
373	GREAT LAKES CHEMICAL CORP	373	AR	GREAT LAKES CHEMICAL CORP. SOUTH PLANT	120768	120768	86098
374	GREAT LAKES CHEMICAL CORP.	374	NE	GREAT LAKES CHEMICAL CO. EL DORADO PLANT	406468	212841	276219
375	GROW GROUP INC.	375	NE	GREAT LAKES CHEMICAL INC.	9281	0	0
376	GROW GROUP INC.	376	NI	GROW GROUP INC.	0	4245	4408
377	GROW GROUP INC.	377	NI	GROW GROUP INC. AUTOMOTIVE DIV.	6368	0	0
378	GROW GROUP INC.	378	CA	GROW GROUP INC. AUTOMOTIVE DIV.	2171	1536	1415
379	GROW GROUP INC.	379	CA	GROW GROUP INC. AUTOMOTIVE DIV.	11420	11430	10253
380	GROW GROUP INC.	380	HA	SERVICE CHEMICAL CORP.	1486	1063	910
381	GROW GROUP INC.	381	HJ	H & S CHEMICAL CO. INC.	355193	0	0
382	GROW GROUP INC.	382	NC	CHEMTRONICS INC.	550	250	253
383	GROW GROUP INC.	383	SC	HALOCARBON PRODUCTS CORP.	92288	524784	633510
384	GROW GROUP INC.	384	WV	HALOCARBON PRODUCTS CORP.	0	230	0
385	GROW GROUP INC.	385	FL	HANLIN CHEMICALS WEST VIRGINIA INC.	7074	7030	4830
			HJ	HATCO CORP.	0	1587	1000
			TX	NATURAL GAS DORRIZING INC.	0	0	0

TOTAL AIR RELEASES FOR SICs 2865 & 2869

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DBS	FACNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
386	HENKEL CORP.	NJ	HENKEL CORP.	14791	15199	15700
387	HENKEL CORP.	NJ	HENKEL CORP.	34094	34129	33163
388	HENKEL CORP.	PA	HENKEL CORP. EMERY GROUP	0	6768	0
389	HENKEL CORP.	PA	HENKEL CORP. EMERY GROUP	6981	0	4989
390	HENKEL CORP.	NC	HENKEL CORP. CHARLOTTE PLANT	177241	295452	146323
391	HENKEL CORP.	CA	HENKEL CORP. EMERY GROUP	14000	13600	14400
392	HENKEL CORP.	CA	HENKEL CORP.	60873	69324	44260
393	HERCULES INC.	NJ	HERCULES INC. BURLINGTON PLANT	109040	108420	100730
394	HERCULES INC.	NJ	HERCULES INC.	83600	78100	99000
395	HERCULES INC.	NJ	HERCULES INC.	896228	957860	260
396	HERCULES INC.	VA	HERCULES INC.	69370	108473	133728
397	HERCULES INC.	VA	AQUALON CO.	1362443	706390	648670
398	HERCULES INC.	GA	HERCULES INC. SPECIALTY CHEMICALS DIV.	118903	139640	54934
399	HERCULES INC.	GA	HERCULES BRUNSWICK PLANT	2721090	2243164	2072486
400	HERCULES INC.	MS	HERCULES INC.	1016840	723063	684218
401	HEUBACH INC.	NJ	HEUBACH INC.	12693	0	0
402	HEXCEL CORP.	NI	HEXCEL CHEMICAL PRODUCTS	209650	164450	0
403	HICKSON DANCHEN CORP.	VA	HICKSON DANCHEN CORP.	0	41293	32232
404	HIGH PLAINS CORP.	KS	HIGH PLAINS CORP.	0	500	500
405	HILLSBORO HOLDINGS CORP.	AL	SLOSS INDUSTRIES CORP. BIRMINGHAM FACILITY	523654	1341125	569749
406	HILLSBORO HOLDINGS CORP.	AL	SLOSS INDUSTRIES CORP. ARIZON FACILITY	13573	13573	730
407	HILTON DAVIS CO.	SC	HILTON DAVIS CO. COMPENS	0	500	0
408	HILTON DAVIS CO.	NJ	HILTON DAVIS CO. NEWARK	500	500	500
409	HILTON DAVIS CO.	OH	HILTON DAVIS CO. CINCINNATI	644571	73531	45213
410	HOECHST CELANESE CHEMICAL GROU	TX	HOECHST CELANESE CHEMICAL GROUP INC.	922496	724065	518159
411	HOECHST CELANESE CHEMICAL GROU	TX	HOECHST CELANESE CHEMICAL GROUP INC. CLEAR LAKE PLANT	2379121	2516671	159880
412	HOECHST CELANESE CHEMICAL GROU	TX	HOECHST CELANESE PANPA PLANT	355640	841800	953105
413	HOECHST CELANESE CORP	RI	HOECHST CELANESE CORP.	23263	35672	39469
414	HOECHST CELANESE CORP	NJ	HOECHST CELANESE NORTHEAST REG. DIST. CENTER	0	0	0
415	HOECHST CELANESE CORP	NJ	HOECHST CELANESE CHEMICAL GROUP	166162	141305	0
416	HOECHST CELANESE CORP	VA	HOECHST CELANESE CORP.	35865	28005	33905
417	HOECHST CELANESE CORP	VA	HOECHST CELANESE	899900	771202	1038001
418	HOECHST CELANESE CORP	NC	HOECHST CELANESE CORP. SOU-TEX	1830	2727	3273
419	HOECHST CELANESE CORP	NC	HOECHST CELANESE CORP.	0	0	0
420	HOECHST CELANESE CORP	NC	CAPE INDUSTRIES	2983051	2929570	5813399
421	HOECHST CELANESE CORP	AL	HOECHST CELANESE CORP.	257352	246846	249010
422	HOECHST CELANESE CORP	IL	HOECHST CELANESE CHEMICAL MIDWEST REGIONAL DISTRICT CTR.	0	0	0
423	HOECHST CELANESE CORP	TX	HOECHST CELANESE BAYPORT WORKS	43200	0	0
424	HOECHST CELANESE CORP	TX	CELANESE ENGINEERING RESINS INC.	1226760	1562160	1778770
425	HOECHST CELANESE CORP	TX	CORPUS CHRISTI TECHNICAL CENTER	28315	2513	10
426	HOLSTON ARMY AMMUNITION PLANT	TX	HOLSTON ARMY AMMUNITION PLANT AMMUNITION PLANT	124200	68000	72636
427	HULS AMERICA INC.	NJ	HULS AMERICA INC.	5535	5447	2999
428	HULS AMERICA INC.	PA	HULS AMERICA INC. BRISTOL PLANT SITE	0	1000	1255
429	HULS AMERICA INC.	MD	HULS AMERICA CHESTERTOWN PLANT	7562	8408	10877
430	HULS AMERICA INC.	AL	KAY-FRIES ALABAMA INC.	39350	43686	48280
431	HUNNEL CHEMICAL CO.	NJ	HUNNEL CROTON INC.	250	250	0
432	HUNTSMAN CHEMICAL CORP.	TX	HUNTSMAN CHEMICAL CORP.	0	40031	28273
433	HYDRITE CHEMICAL CO.	IA	HYDRITE CHEMICAL CO.	3254	2682	1159
434	HYDRITE CHEMICAL CO.	WI	HYDRITE CHEMICAL CO.	2050	1661	2137
435	HYDRITE CHEMICAL CO.	WI	HYDRITE CHEMICAL CO.	8634	7411	6963
436	HYDRITE CHEMICAL CO.	WI	HYDRITE CHEMICAL CO.	4311	5031	4161
437	HYDRITE CHEMICAL CO.	WI	HYDRITE CHEMICAL CO.	1321	1384	752
438	HYDROL CHEMICAL CO	PA	HYDROL CHEMICAL CO.	562	529	640
439	ICC INDUSTRIES INC.	OH	ICC INDUSTRIES DOVER CHEMICAL CORP.	1002	0	0
440	ICC INDUSTRIES INC.	OH	ICC INDUSTRIES DOVER CHEMICAL CORP.	0	503	510

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DBS	PARNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
441	ICI AMERICAS INC.	MA	ICI AMERICAS INC. DIGHTON WORKS	78557	53400	6311
442	ICI AMERICAS INC.	DE	ICI AMERICAS INC. ATLAS POINT SITE	52547	53920	37927
443	ICI AMERICAS INC.	AL	ICI AMERICAS INC. COLD CREEK PLANT	5038	4837	5444
444	ICI AMERICAS INC.	TX	ICI AMERICAS INC. NT. PLEASANT PLANT	18680	23215	54286
445	INCERA	NJ	MALLINCKRODT SPECIALTY CHEMICALS CO. (VAN DYK)	12800	16149	18248
446	INCERA	NC	MALLINCKRODT SPECIALTY CHEMICALS CO.	200331	830667	1131350
447	INCERA	KY	MALLINCKRODT SPECIALTY CHEMICALS CO.	4310	5386	5015
448	INCERA	TX	PLITHAN-MOORE INC.	30000	28500	27300
449	INCERA	ND	MALLINCKRODT SPECIALTY CHEMICALS CO.	671434	627358	724758
450	INDSPEC CHEMICALS INC.	PA	INDSPEC CHEMICAL CORP.	8226	31153	8650
451	INDSPEC CHEMICALS INC.	PA	INDSPEC CHEMICAL CORP.	0	240	0
452	INDUSTRIAL COLOR INC.	IL	INDUSTRIAL COLOR INC.	0	0	0
453	INLAND SPECIALTY CHEMICAL CORP	IN	INLAND SPECIALTY CHEMICAL CORP.	1132	793	0
454	INDOLEX CHEMICAL CO.	PA	INDOLEX CHEMICAL CO.	0	5451	5340
455	INTERFACE INC.	GA	ROCKLAND REACT-RITE INC.	12000	1000	0
456	INTERFACE INC.	GA	ROCKLAND REACT-RITE INC.	500	500	500
457	INTERFACE INC.	AL	ROCKLAND REACT-RITE INC.	500	500	500
458	INTERNATIONAL FLAVORS & FRAGR	NJ	INTERNATIONAL FLAVORS & FRAGRANCES INC.	6854	6631	4020
459	INTERNATIONAL MINERALS & CHEMI	LA	ANGUS CHEMICAL CO.	392560	498240	0
460	INTERNATIONAL PAPER	FL	ARIZONA CHEMICAL CO.	0	0	88702
461	INTERNATIONAL SPECIALITY PRODU	NJ	SUTTON LABORATORIES INC.	500	500	500
462	INTERNATIONAL SPECIALITY PRODU	KY	ISP CHEMICALS INC.	342568	91262	72641
463	IVAX CORP.	SC	IVAX INDUSTRIES INC. TEXTILE PRODUCTS DIV.	4012	5662	5412
464	J. I. CASE	WA	ALBRIGHT & WILSON AMERICAS INC.	292970	199007	315268
465	JANES RIVER CORP.	CA	JANES RIVER II INC. CANAS HILL	250000	331300	294550
466	JBL SCIENTIFIC	CA	JBL SCIENTIFIC	40	0	0
467	JOHANN HALTERMAN LTD.	TX	HALTERMAN LTD.	1277	2290	0
468	KALAMA CHEMICAL INC.	NJ	KALAMA CHEMICAL INC. GARFIELD PLANT	245975	181739	233148
469	KALAMA CHEMICAL INC.	WA	KALAMA CHEMICAL INC.	848040	471590	695240
470	KENRICH PETROCHEMICALS INC.	NJ	KENRICH PETROCHEMICALS INC.	0	5395	4534
471	KENTUCKY AGRICULTURAL ENERGY C	KY	KENTUCKY AGRICULTURAL ENERGY CORP.	0	0	33
472	KING INDUSTRIES INC.	CT	KING INDUSTRIES INC.	0	2230	2390
473	KNOX INC	TX	KNOX INC.	2260	5300	5300
474	KNOX INDUSTRIES INC.	NI	KNOX REFINING KNOX CHEMICAL CO. DIV.	141034	105946	157366
475	KNOX INDUSTRIES INC.	KS	KNOX CHEMICAL CO. JAYHAWK PLANT	116569	71864	37213
476	KOPPERS INDUSTRIES INC.	WV	KOPPERS INDUSTRIES INC.	138062	74150	56789
477	KOPPERS INDUSTRIES INC.	AL	KOPPERS INDUSTRIES INC.	18815	13508	6677
478	KOPPERS INDUSTRIES INC.	IL	KOPPERS INDUSTRIES INC.	104067	98076	58428
479	KOPPERS INDUSTRIES INC.	TX	KOPPERS INDUSTRIES INC.	13039	17167	10615
480	KORE MART LTD	PA	KORE MART LTD.	0	750	0
481	KRAMER CHEMICALS INC.	NJ	KRAMER CHEMICALS INC.	250	0	0
482	LAROCHE HOLDINGS INC.	LA	LAROCHE CHEMICALS INC.	15690	295620	14600
483	LINDAU CHEMICALS INC.	SC	LINDAU CHEMICALS INC.	8890	16200	7355
484	LINEAR DYNAMICS INC.	GA	LINEAR DYNAMICS INC.	167707	174061	81852
485	LOBECO PRODUCTS INC	SC	LOBECO PRODUCTS INC.	5210	6050	3733
486	LONZA INC.	GA	BIDLAB INC.	572	923	0
487	LONZA INC.	IL	LONZA INC.	274	269	386
488	LONZA INC.	TX	LONZA GAYPORT	5300	3850	3605
489	LUBRIZOL CORP.	OH	LUBRIZOL PETROLEUM CHEMICALS CO.	183984	267713	243038
490	LUBRIZOL CORP.	OH	LUBRIZOL CORP.	28946	18457	3069
491	LUBRIZOL CORP.	TX	LUBRIZOL PETROLEUM CHEMICALS CO. BAYPORT PLANT	148603	207115	261953
492	LUBRIZOL CORP.	TX	LUBRIZOL PETROLEUM CHEMICALS DEER PARK	165386	192071	159214
493	LYONDELL PETROCHEMICAL CO	TX	LYONDELL PETROCHEMICAL CO.	916729	781485	1060779
494	MAGRUDER COLOR CO. INC.	NJ	INDOL COLOR CO. INC.	0	0	0
495	MAGRUDER COLOR CO. INC.	CA	RADIANT COLOR	250	500	5

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OBS	PARNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
496	NAK CHEMICAL CORP.	IN	NAK CHEMICAL CORP.	0	0	5
497	NARLOWE - VAN LOAN CORP.	KC	NARLOWE - VAN LOAN CORP.	250	250	250
498	MCINTYRE GROUP LTD.	IL	MCINTYRE GROUP LTD.	1000	0	0
499	MERCK & CO. INC.	PA	CALCON CORP.	1136	0	0
500	MERCK & CO. INC.	PA	CALCON CORP.	0	677	706
501	MERCK & CO. INC.	CA	KELCO DIV. OF MERCK & CO. INC.	815050	572250	30781
502	MERICHEN CO.	TX	MERICHEN CO.	12926	38053	67655
503	MERICHEN CO. INC.	AL	MERICHEN CO. INC.	400	0	0
504	MFG. SOAP & CHEMICAL CO.	TN	MANUFACTURERS SOAP & CHEMICAL CO. INC.	0	0	10
505	MICHIGAN RECOVERY SYSTEMS INC.	MI	MICHIGAN RECOVERY SYSTEMS INC.	23000	0	0
506	MICHLIN DIAZO PRODUCTS CORP.	MI	MICHLIN DIAZO PRODUCTS CORP.	0	0	250
507	MID-AMERICAN CORP.	TX	MID-AMERICAN CORP.	750	20	10
508	MIDWEST INDUSTRIAL SUPPLY INC.	OH	MIDWEST INDUSTRIAL SUPPLY INC.	0	0	0
509	MILES INC.	NH	HAARMANN & REIMER CORP.	0	3	0
510	MILES INC.	NH	HAARMANN & REIMER CORP.	250	0	10
511	MILLIKEN & CO.	SC	MILLIKEN CHEMICAL DEWEY PLANT	76129	75019	11633
512	MILLIKEN & CO.	SC	MILLIKEN CHEMICAL CYPRESS PLANT	41	2190	39752
513	MITSUBISHI INTERNATIONAL CORP	OH	ARISTECH CHEMICAL CORP.	0	2077000	0
514	MITSUBI TSUTSU/YANAMOTO CHEMICA	MI	EAST SHORE CHEMICAL CO.	0	0	47991
515	MOBAY CORP.	NJ	STAFLEX SPECIALTY ESTERS INC.	1333	4272	29222
516	MOBAY CORP.	NJ	MOBAY CORP.	120338	135788	184040
517	MOBAY CORP.	TX	MOBAY SYNTHETICS CORP.	485394	397684	491990
518	MOBIL CORP.	NJ	MOBIL CHEMICAL CO. CHEM. PROD. DIV.	11672	3874	0
519	MOBIL CORP.	NJ	MOBIL CHEMICAL CO. CHEMICAL PRODUCTS DIV.	0	0	6800
520	MOBIL CORP.	TX	MOBIL CHEMICAL CO.	25100	31700	70182
521	MOBIL CORP.	TX	MOBIL CHEMICAL CO. BCSP	465490	2464	3436
522	MOBIL CORP.	TX	MOBIL CHEMICAL CO. OLEFIN/AROMATICS PLANT	0	398981	227103
523	MOBIL CORP.	TX	NECHES RIVER TREATMENT CORP. LOWER NECHES VALLEY AUTHORITY	223290	191330	206437
524	MONSANTO CO.	MA	MONSANTO CO.	130332	132915	170130
525	MONSANTO CO.	MA	MONSANTO CO.	1811	9293	11391
526	MONSANTO CO.	NJ	MONSANTO CO.	19140	14630	12320
527	MONSANTO CO.	NJ	MONSANTO CO.	48273	39218	41143
528	MONSANTO CO.	WV	MONSANTO CO.	466760	549145	379745
529	MONSANTO CO.	GA	KUTRASWEET CO.	101400	71600	79600
530	MONSANTO CO.	FL	MONSANTO CO.	54000	35800	77400
531	MONSANTO CO.	AL	MONSANTO CO.	191617	200191	170990
532	MONSANTO CO.	AL	MONSANTO CO.	48380	44080	0
533	MONSANTO CO.	OH	MONSANTO CO.	8084	16813	7768
534	MONSANTO CO.	MI	MONSANTO CO.	33001	34813	43958
535	MONSANTO CO.	IL	KUTRASWEET CO.	158600	409200	302500
536	MONSANTO CO.	IL	MONSANTO CO.	1928130	1876450	1002800
537	MONSANTO CO.	MO	MONSANTO CO.	113152	440102	394012
538	MONSANTO CO.	LA	MONSANTO CO.	64361	31542	0
539	MONSANTO CO.	TX	MONSANTO CO.	339800	422475	225409
540	MONSANTO CO.	CA	MONSANTO CO.	146000	167000	144000
541	MOOREY CHEMICALS INC.	PA	MOOREY CHEMICALS INC.	6	13	8
542	MOORE BUSINESS FORMS & SYSTEMS	OK	MOORE BUSINESS FORMS & SYSTEMS DIV.	538717	481060	422185
543	MORTON THIOKOL INC.	MA	MORTON INTERNATIONAL INC. (DAC)	77000	36400	10000
544	MORTON THIOKOL INC.	NJ	MORTON INTERNATIONAL INC. (PATERSON)	23200	21300	20376
545	MORTON THIOKOL INC.	MS	MORTON INTERNATIONAL SPECIALTY CHEMICAL GROUP	0	250	0
546	MORTON THIOKOL INC.	MS	MORTON INTERNATIONAL INC. (MPD)	23450	20500	22500
547	MORTON THIOKOL INC.	MS	MORTON INTERNATIONAL SPECIALTY CHEMICAL GROUP	6500	6250	0
548	MORTON THIOKOL INC.	MS	MORTON INTERNATIONAL POLYMER SYSTEMS	0	0	7174
549	MORTON THIOKOL INC.	OH	MORTON INTERNATIONAL INC.	78700	67800	85500
550	NTN AMERICAS	SC	NTN HARDWICKE INC.	20291	28286	158778

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DBS	FACNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
551	NTM AMERICAS	SC	TRAYBOR INC.	0	750	72110
552	NTM AMERICAS	OH	NTM CHEMICALS INC.	1051	564	765
553	HA	DE	STANDARD CHLORINE OF DELAWARE INC.	44332	247352	206024
554	HAAMLOZE VERMOOTSCHAP DSM	GA	DSM CHEMICALS NORTH AMERICA INC.	1985300	1448541	1366388
555	HALCO CHEMICAL CO.	GA	HALCO CHEMICAL CO.	2804	2204	0
556	HALCO CHEMICAL CO.	IL	HALCO CHEMICAL CO.	13287	2614	2504
557	HALCO CHEMICAL CO.	LA	HALCO CHEMICAL CO.	8286	6766	7469
558	HALCO CHEMICAL CO.	TX	HALCO CHEMICAL CO.	78225	72863	44489
559	HALCO CHEMICAL CO.	TX	HALCO CHEMICAL CO.	0	0	2777
560	NATIONAL STARCH & CHEMICAL CO	NC	NATIONAL STARCH & CHEMICAL CO.	82846	454337	457647
561	NATIONAL STARCH & CHEMICAL CO	NC	NATIONAL STARCH & CHEMICAL CO.	323172	394097	333431
562	NATIONAL STARCH & CHEMICAL CO	TX	ALCO CHEMICAL CORP.	0	1827	2355
563	NATIONAL STARCH & CHEMICAL CO	IL	NATIONAL STARCH & CHEMICAL CO.	103968	235337	199035
564	HATROCHEN INC.	GA	HATROCHEN INC.	0	0	0
565	HCR CORP.	TX	HCR CORP. MPD SYSTEMEDIA GROUP	31574	21562	14395
566	NESTLE FOODS CORP.	CA	NESTLE FOOD CO.	0	0	0
567	NEVILLE CHEMICAL CO.	PA	NEVILLE CHEMICAL CO.	16150	10500	16260
568	NEW CHURCH ENERGY ASSOCIATES	VA	NEW CHURCH ENERGY ASSOCIATES	0	0	10
569	NEW ENERGY CORP.	TX	NEW ENERGY CO. OF INDIANA	17988	15277	15027
570	NEW ENGLAND TAPE CO.	NE	DELTA CHEMICALS INC.	500	500	10
571	NEWELL CORP.	WV	NEWELL SPECIALTY CHEMICALS INC.	2500	3250	0
572	HOR-AN CHEMICAL CO.	MI	HOR-AN CHEMICAL CO.	0	0	13808
573	HORAC CO. INC.	AR	HORAC CO. INC.	1000	1000	1010
574	HORAC CO. INC.	CA	HORAC CO. INC.	11500	0	0
575	HOTTINGHAM CO	GA	HOTTINGHAM CO.	0	0	0
576	HU-BRITE CHEMICAL CO.	PA	STERLING GROUP	3000	6500	17700
577	OCCIDENTAL PETROLEUM CORP.	WV	OCCIDENTAL CHEMICAL CORP.	1096930	827745	0
578	OCCIDENTAL PETROLEUM CORP.	LA	OXY PETROCHEMICALS INC.	89170	17000	0
579	OCCIDENTAL PETROLEUM CORP.	NY	OCCIDENTAL CHEMICAL CORP. NIAGARA PLANT	80885	43655	40481
580	OCCIDENTAL PETROLEUM CORP.	OH	OCCIDENTAL CHEMICAL CORP.	32644	28885	36775
581	OCCIDENTAL PETROLEUM CORP.	LA	OXYCHEN PETROCHEMICALS LAKE CHARLES PLANT	0	95480	127362
582	OCCIDENTAL PETROLEUM CORP.	LA	OCCIDENTAL CHEMICAL CORP.	78228	7079	2425
583	OCCIDENTAL PETROLEUM CORP.	TX	OXY PETROCHEMICALS INC. BAYPORT SITE	176350	146800	101345
584	OCCIDENTAL PETROLEUM CORP.	TX	OXYCHEN PETROCHEMICALS	482000	512050	356505
585	OCCIDENTAL PETROLEUM CORP.	TX	OCCIDENTAL CHEMICAL CORP. UCM PLANT	0	61782	6528
586	OCCIDENTAL PETROLEUM CORP.	TX	OCCIDENTAL CHEMICAL CORP.	328475	223630	109270
587	OCCIDENTAL PETROLEUM CORP.	TX	PD GLYCOL	3800	3800	3006
588	OCCIDENTAL PETROLEUM CORP.	TX	OCCIDENTAL CHEMICAL CORP. CORPUS CHRISTI PLANT	0	0	30271
589	OCCIDENTAL PETROLEUM CORP.	TX	OXY PETROCHEMICALS CORPUS CHRISTI PLANT	166500	182350	409800
590	OLIN CORP	RI	OLIN HUNT SPECIALTY PRODUCTS INC.	24198	19409	11502
591	OLIN CORP	NY	OLIN CHEMICALS	0	198719	172581
592	OLIN CORP	NY	OLIN CORP.	33673	25042	20037
593	OLIN CORP	AL	OLIN CORP.	22	605	13
594	OLIN CORP	KY	OLIN CORP.	55358	64690	57894
595	OLIN CORP	LA	OLIN CORP. LAKE CHARLES PLANT	679982	395477	141460
596	OLIN CORP.	RI	OLIN HUNT SPECIALTY PRODUCTS INC.	7239	0	0
597	OMEGA-CHEMICALS INC.	SC	OMEGA-CHEMICALS INC.	0	0	0
598	ORIENT CHEMICAL CORP.	HJ	ORIENT CHEMICALS INC.	4273	4253	3650
599	PAT-CHEN INC.	NY	PAT-CHEN INC.	0	50	50
600	PAT-CHEN INC.	SC	YORKSHIRE PAT-CHEN INC.	2	2	5
601	PCL GROUP INC.	OH	CYCHEN	67520	31381	35000
602	PCL GROUP INC.	OH	PHILALCHEN	1008935	755296	38300
603	PCL GROUP INC.	MI	LOMAC INC.	289551	893792	989415
604	PCR INC.	FL	PCR INC.	250	1500	2000
605	PEKIN ENERGY CO.	IL	PEKIN ENERGY CO.	0	250	277

TOTAL AIR RELEASES FOR SICS 2865. & 2869

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DBS	PARNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
606	PELROM CORP.	IL	PELROM CORP.	0	0	0
607	PENHWALT CORP.	NJ	M & T CHEMICALS INC.	1095	1095	1095
608	PENHWALT CORP.	NY	ATOCHEN NORTH AMERICA INC. ORG. PEROXIDES DIV.	67800	62756	64236
609	PENHWALT CORP.	PA	ATOCHEN N. AMERICA	0	0	20
610	PENHWALT CORP.	AL	ATOCHEN NORTH AMERICA INC.	50712	70934	78638
611	PENHWALT CORP.	KY	ATOCHEN NORTH AMERICA INC.	43350	36998	33044
612	PENHWALT CORP.	KY	ATOCHEN NORTH AMERICA INC.	26650	35762	27100
613	PENHWALT CORP.	NI	ATOCHEN NORTH AMERICA INC. RIVERVIEW	13250	5583	6190
614	PENHWALT CORP.	NH	ATOCHEN NORTH AMERICA INC.	1653	2095	2288
615	PENHWALT CORP.	TX	ATOCHEN NORTH AMERICA INC.	7494	2976	3363
616	PENHWALT CORP.	TX	ATOCHEN NORTH AMERICA CROSBY PLANT	18684	3127	3582
617	PENHWALT CORP.	TX	ATOCHEN NORTH AMERICA INC.	7000	7191	4726
618	PENHWALT CORP.	GA	FARN & INDUSTRIAL CHEMICAL CO.	1000	0	0
619	PERSTORP POLYOLS INC.	OH	PERSTORP POLYOLS INC.	6900	6800	7005
620	PFISTER CHEMICAL INC.	NJ	ALLIANCE CHEMICAL INC.	8700	6600	3820
621	PFISTER CHEMICAL INC.	NJ	PFISTER CHEMICAL INC.	41410	26708	9420
622	PHILLIPS PETROLEUM CO	OH	CATALYST RESOURCES INC.	2405	885	780
623	PHILLIPS PETROLEUM CO	OK	PHILLIPS RESEARCH CENTER	586	806	5609
624	PHILLIPS PETROLEUM CO	TX	PHILLIPS 66 CO. HOUSTON CHEMICAL COMPLEX	73720	36421	110935
625	PHILLIPS PETROLEUM CO	TX	PHILLIPS 66 CO. PHILTEX/RYTON COMPLEX	249410	231257	75927
626	PIERCE CHEMICAL MORTICIAN SUPP	MO	ROYAL BOND INC.	1000	1500	2650
627	PIERCE CHEMICAL MORTICIAN SUPP	TX	PIERCE CHEMICALS MORTICIANS SUPPLY	11678	93600	35700
628	PILDT CHEMICAL CO.	TX	PILDT INDUSTRIES OF TEXAS INC.	14661	18497	9767
629	PITHAM MOORE INC.	PA	PITHAM-MOORE INC. ALLENTOWN PLANT	43400	44217	32213
630	PLASTICS ENGINEERING CO.	WI	PLASTICS ENGINEERING CO.	3925	0	0
631	PLASTICS ENGINEERING CO.	WI	PLASTICS ENGINEERING CO.	0	1404	0
632	PLASTICS ENGINEERING CO.	WI	PLASTICS ENGINEERING CO.	8013	8269	0
633	PNC INC.	NJ	PNC SPECIALTIES GROUP	8636	8810	8484
634	PNC INC.	OH	PNC SPECIALTIES GROUP	241250	233512	200703
635	PNC INC.	IL	PNC SPECIALTIES GROUP CHICAGO PLANT	1738333	739094	707549
636	PNC INC.	CA	PNC SPECIALTIES GROUP INC.	15039	84483	145606
637	POLYMER APPLICATIONS INC.	NY	POLYMER APPLICATIONS INC.	364300	0	0
638	PPG INDUSTRIES INC.	WV	PPG INDUSTRIES INC.	513150	443090	503055
639	PPG INDUSTRIES INC.	OH	PPG INDUSTRIES INC. BARBERTON PLANT & TECH CTR.	27625	22257	23376
640	PPG INDUSTRIES INC.	LA	PPG INDUSTRIES INC.	1785323	1803856	1583029
641	PPG INDUSTRIES INC.	TX	PPG INDUSTRIES	10234	4599	2466
642	PRESSURE CHEMICAL CO.	PA	PRESSURE CHEMICAL CO.	8516	5528	12265
643	PRIHA INC.	NC	NESTE RESINS CORP.	283971	262500	252600
644	PRIHA INC.	AL	CHEMBOND CORP.	376100	0	0
645	PRIHA INC.	AL	NESTE RESINS CORP.	0	378300	127400
646	PRIHA INC.	LA	CHEMBOND CORP.	54379	210018	230582
647	PRIHA INC.	OR	NESTE RESINS CORP.	156850	158100	146700
648	PROCHEN CHEMICALS INC	NC	PROCHEN CHEMICALS INC.	0	250	510
649	PROCTER & GAMBLE	KS	PROCTER & GAMBLE MFG. CO.	1266220	776206	289280
650	PROCTER & GAMBLE	TX	JETCO CHEMICALS	22634	56638	12278
651	PRODUCT-SOL INC.	NI	PRODUCT-SOL INC.	5000	0	0
652	QUANTUM CHEMICAL CORP.	NJ	QUANTUM CHEMICAL CORP. USI DIV.	500	500	0
653	QUANTUM CHEMICAL CORP.	IA	QUANTUM CHEMICAL CORP. USI DIV.	344610	191025	116210
654	QUANTUM CHEMICAL CORP.	IL	QUANTUM CHEMICAL CORP. USI DIV.	279400	129800	153255
655	QUANTUM CHEMICAL CORP.	IL	QUANTUM CHEMICAL CORP. USI DIV. TUSCOLA FACILITY	84724	76827	79802
656	QUANTUM CHEMICAL CORP.	IL	QUANTUM - USI TUSCOLA FACILITY	640	0	0
657	QUANTUM CHEMICAL CORP.	TX	QUANTUM CHEMICAL CORP. USI DIV. DEER PARK PLANT	153787	212819	214190
658	QUANTUM CHEMICAL CORP.	CA	QUANTUM CHEMICAL CORP. USI DIV. ANAHEIM PLANT	1500	1000	1000
659	R. B. FANPLIN CORP.	SC	MOUNT VERNON HILLS RIECHEN PLANT	8	5	45
660	R. T. VANDERBILT CO. INC.	CT	VANDERBILT CHEMICAL CORP.	1206	158	191

OBS	FACNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
661	R. T. VANDERBILT CO. INC.	KY	VANDERBILT CHEMICAL CORP.	409	492	411
662	R-M INDUSTRIES INC.	SC	R-M INDUSTRIES INC.	1000	1500	42844
663	RAGU FOODS INC.	IL	UNICHEMA NORTH AMERICA	0	0	0
664	RAYCHEN CORP.	CA	RAYCHEN CORP.	130137	70950	0
665	REILLY INDUSTRIES INC.	NC	NORFLEX INC.	6489	0	15721
666	REILLY INDUSTRIES INC.	OH	REILLY INDUSTRIES INC.	91606	84657	74901
667	REILLY INDUSTRIES INC.	IN	REILLY INDUSTRIES INC.	59176	31251	37434
668	REILLY INDUSTRIES INC.	IL	TREKKER CHEMICAL	30301	0	0
669	REILLY INDUSTRIES INC.	IL	REILLY INDUSTRIES INC.	1385	51353	41438
670	REILLY INDUSTRIES INC.	TX	REILLY INDUSTRIES INC.	4500	5000	4500
671	REILLY INDUSTRIES INC.	UT	REILLY INDUSTRIES INC.	20477	41023	21838
672	REXENE CORP.	TX	REXENE PRODUCTS CO. POLYPROPYLENE PLANT	530630	433296	353193
673	RFS CORP.	NA	ROMA COLOR INC.	31000	1500	140
674	RHO CHEMICAL CO. INC.	IL	RHO CHEMICAL CO. INC.	0	0	10
675	RHONE-POULENC INC.	NJ	RHONE-POULENC SPECIALTY CHEMICALS L.P.	186250	213163	81680
676	RHONE-POULENC INC.	PA	NSO CO.	6400	106476	83447
677	RHONE-POULENC INC.	ND	RHONE-POULENC SURFACTANTS & SPECIALTIES	3340	1941	1176
678	RHONE-POULENC INC.	WV	RHONE-POULENC AG CO. INSTITUTE, WV PLANT OPERATIONS	886640	0	0
679	RHONE-POULENC INC.	GA	RHONE-POULENC LYNDAL CHEMICALS	693	729	765
680	RHONE-POULENC INC.	FL	RHONE-POULENC POLYPURE WATER TREATMENT CHEMICALS	789	28	27
681	RHONE-POULENC INC.	ND	RHONE-POULENC INC.	0	40800	28420
682	RHONE-POULENC INC.	ND	RHONE-POULENC SURFACTANTS & SPECIALTIES LP	2500	1454	1445
683	RHONE-POULENC INC.	LA	RHONE-POULENC BASIC CHEMICAL CO.	0	0	4712
684	RHONE-POULENC INC.	TX	RHONE-POULENC INC. FREEPORT PLANT	90200	139400	132885
685	RHONE-POULENC INC.	CA	RHONE-POULENC POLYPURE WATER TREATMENT CHEMICALS	0	0	265
686	RHONE-POULENC INC.	WA	RHONE-POULENC INC.	570000	636166	425990
687	RIVER VALLEY COATINGS INC	IL	RIVER VALLEY COATINGS INC.	0	13650	13255
688	ROHM & HAAS CO.	PA	SUPELCO INC.	3800	6200	7400
689	ROHM & HAAS CO.	PA	ROHM & HAAS DELAWARE VALLEY INC.	313603	252952	247226
690	ROHM & HAAS CO.	PA	ROHM & HAAS DVI PHILADELPHIA PLANT	258753	248189	206421
691	ROHM & HAAS CO.	TX	ROHM & HAAS INC. TENNESSEE	27880	98310	40720
692	ROHM & HAAS CO.	TX	ROHM & HAAS INC. TEXAS	2288762	1816423	332088
693	ROHM & HAAS CO.	TX	ROHM & HAAS BAYPORT INC.	742	150	159
694	ROHM TECH. INC.	MA	ROHM TECH INC.	5000	19057	4500
695	ROYCE ASSOCIATES ALP	NJ	ROYCE ASSOC. PASSAI COLOR & CHEM. DIV.	0	0	0
696	ROYCE ASSOCIATES ALP	NJ	ROYCE ASSOCIATES PASSAIC COLOR & CHEM. DIV.	0	0	0
697	RPM INC.	OH	EUCLID CHEMICAL CO.	10345	28	0
698	RSA CORP.	NY	RSA CORP.	5550	4150	2850
699	RUETGERS-NEASE CHEMICAL CO. IN	PA	RUETGERS-NEASE CHEMICAL CO. INC.	13741	0	0
700	RUETGERS-NEASE CHEMICAL CO. IN	CA	RUETGERS-NEASE CHEMICAL CO. INC.	320	600	790
701	RUETGERS-NEASE CHEMICAL CO. IN	OH	RUETGERS-NEASE CHEMICAL CO. INC.	25300	0	0
702	SACHEN INC.	TX	SACHEN INC.	0	0	132
703	SAN JUAN FIBERGLASS POOLS INC.	CA	SAN JUAN FIBERGLASS POOLS INC.	34000	0	0
704	SANDOZ CHEMICALS CORP.	NJ	SANDOZ CHEMICALS CORP. FAIR LAWN	5020	4900	1555
705	SANDOZ CHEMICALS CORP.	NC	SANDOZ CHEMICALS CORP. MT. HOLLY PLANT	40415	9900	12963
706	SANDOZ CHEMICALS CORP.	SC	SANDOZ CHEMICALS CORP. MARTIN PLANT	8770	4403	2570
707	SARTONER CO. INC. NC	CT	SARTONER CO. INC. CT.	3757	5333	5325
708	SARTONER CO. INC. NC	PA	SARTONER CO. INC. NC	84434	45762	44994
709	SCHENECTADY CHEMICALS INC	NY	SCHENECTADY CHEMICALS INC.	500389	462497	425797
710	SCHENECTADY CHEMICALS INC	TX	SCHENECTADY CHEMICALS INC.	5060	5420	25256
711	SCHER CHEMICALS INC.	NJ	SCHER CHEMICALS INC.	500	500	0
712	SCHERING CORP.	IL	SHEREX CHEMICAL CO. INC.	821730	640000	327985
713	SEABOARD CHEMICAL CORP.	NC	SEABOARD CHEMICAL CORP.	38654	0	0
714	SEQUA CORP.	SC	SEQUA CHEMICALS INC.	7195	6607	9288
715	SHELL OIL CO.	LA	SHELL OIL CO. NORCO MFG. COMPLEX	588010	884550	609560

TOTAL AIR RELEASES FOR SICs 2865 & 2869

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DBS	PARNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
716	SHELL OIL CO.	LA	SHELL OIL CO. HORCO MFG. COMPLEX - WEST	0	0	226220
717	SHELL OIL CO.	LA	SHELL CHEMICAL CO. GEISMAR PLANT	1593500	1328420	977526
718	SHELL OIL CO.	TX	SHELL OIL CO. DEER PARK MFG. COMPLEX	1464450	3498072	2953088
719	SHELL OIL CO.	CA	SHELL OIL CO. MARTINEZ MANUFACTURING COMPLEX	65707	66070	97008
720	SHEPHERD CHEMICAL CO.	OH	SHEPHERD CHEMICAL CO.	2	2	2
721	SHERBORNE GROUP INC.	NY	BUFFALO COLOR CORP.	114846	274301	270475
722	SHIPLEY CO. INC.	MA	SHIPLEY CO. INC.	1000	1000	1930
723	SHU CHEN INC.	TX	KEESHAN & DOST CHEMICAL CO. INC.	1000	1300	1000
724	SIGMA-ALDRICH CORP.	WI	ALDRICH CHEMICAL CO. INC.	500	750	2255
725	SIGMA-ALDRICH CORP.	WI	ALDRICH CHEMICAL CO. INC.	0	750	1250
726	SIGMA-ALDRICH CORP.	WI	ALDRICH CHEMICAL CO. INC.	1468	1467	1532
727	SIGMA-ALDRICH CORP.	WI	ALDRICH CHEMICAL CO. INC.	2500	2500	1000
728	SIGMA-ALDRICH CORP.	ND	SIGMA CHEMICAL CO.	4088	750	1510
729	SIGMA-ALDRICH CORP.	ND	SIGMA CHEMICAL CO.	24193	22289	38585
730	SINCLAIR & VALENTINE L. P.	PA	RIDGWAY COLOR CO.	0	0	0
731	SOLVENT MANUFACTURING CO INC	OK	SOLVENT MANUFACTURING CO. INC.	0	250	0
732	SOLVENTS & CHEMICALS INC.	TX	SOLVENTS & CHEMICALS INC.	5976	0	8937
733	SOUTHWESTERN ANALYTICAL CHEMICAL	TX	SACHEM INC. CHEMICALS INC.	143	466	732
734	STEPAN CO.	NJ	STEPAN CO.	0	0	3976
735	STEPAN CO.	IL	STEPAN CO. HILLSDALE PLANT	491453	333774	337270
736	STERLING CHEMICALS INC.	TX	STERLING CHEMICALS INC.	867150	633340	719860
737	STINSON LUMBER CO.	WA	NORTHWEST PETROCHEMICAL CORP.	1000	0	1000
738	STOCKHAUSEN INC.	NC	STOCKHAUSEN INC.	4250	7450	9810
739	STONER INC.	PA	STONER INC.	2250	2500	1750
740	SUNBELT CORP.	SC	SUNBELT CORP.	250	250	250
741	SYBRON CHEMICALS INC.	NJ	SYBRON CHEMICALS INC.	42411	44356	44208
742	SYBRON CHEMICALS INC.	SC	SYBRON CHEMICALS INC.	0	0	8762
743	SYNALLDY CORP.	SC	BLACKMAN UHLER CHEMICAL DIV.	1000	500	63
744	SYNALLDY CORP.	GA	BLACKMAN UHLER CHEMICAL DIV. - AUGUSTA CHEM. FACILITY	0	0	5800
745	SYNTEX AGRIBUSINESS INC.	ND	SYNTEX AGRIBUSINESS INC.	1571027	2158330	2024302
746	TANA CHEMICALS CO LTD	WA	MOSES LAKE INDUSTRIES	0	250	5
747	TECH SPRAY INC	TX	TECH SPRAY INC.	0	3500	3500
748	TEKHOR APEX CO.	MA	TEKHOR APEX CO.	2666	2378	1358
749	TELEDYNE MCCORMICK SELPH	CA	TELEDYNE MCCORMICK SELPH	15	0	0
750	TENNESSEE VALLEY PERFORMANCE P	TN	TENNESSEE VALLEY PERFORMANCE PRODUCTS INC.	13978	24943	164363
751	TEXACO INC.	KS	TEXACO REFINING & MARKETING INC. EL DORADO PLANT	1145880	1167311	1152580
752	TEXACO INC.	TX	TEXACO CHEMICAL CO.	63162	53320	50813
753	TEXACO INC.	TX	TEXACO CHEMICAL CO. PORT ARTHUR CHEMICAL PLANT	433250	484300	274611
754	TEXACO INC.	TX	TEXACO CHEMICAL CO.	934202	707080	626360
755	TEXACO INC.	TX	TEXACO CHEMICAL CO.	11550	19750	12103
756	TEXAS ALKYL INC.	TX	TEXAS ALKYL INC.	9150	11987	9696
757	TEXAS OLEFINS CO.	TX	TEXAS PETROCHEMICALS CORP.	228337	269217	251081
758	THE DOW CHEMICAL CO	ND	ESSEX INDUSTRIAL CHEMICALS INC.	1829	44	0
759	THE DOW CHEMICAL CO	LA	DOW CHEMICAL CO. GRAND BAYOU PLANT	673	32319	0
760	THE QUAKER OATS CO	IA	QUAKER OATS CO.	1100	220	198
761	TOWER CHEMICAL CORP.	PA	TOWER CHEMICAL CORP.	0	0	25
762	TRANS RESOURCES INC.	AR	CEDAR CHEMICAL CORP.	4000	2000	3010
763	TRANSTECHNOLOGY CORP.	PA	FEDERAL LABORATORIES PYRO DIV.	29100	27516	34900
764	TRAYLOR INC	SC	TRAYLOR INC.	0	1000	0
765	UNION CAMP CORP.	FL	UNION CAMP CORP. BBA DIV. A&T CHEMICALS	101205	66993	39157
766	UNION CAMP CORP.	OH	UNION CAMP CORP.	18510	24425	38208
767	UNION CARBIDE CORP	WV	UNION CARBIDE C & P CO. INSTITUTE WV PLANT OPERATIONS	441508	382268	419954
768	UNION CARBIDE CORP	WV	UNION CARBIDE CHEMICALS & PLASTICS CO. HOLZ IMPOUNDMENT	0	1971	2774
769	UNION CARBIDE CORP	WV	UNION CARBIDE CORP. TECHNICAL CENTER	11672	8450	560
770	UNION CARBIDE CORP	WV	UNION CARBIDE CHEMICALS & PLASTICS CO. INC.	1119859	805323	170181

TOTAL AIR RELEASES FOR SICS 2865 & 2869

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OBS	PARNAME	STATE	FACNAME	YEAR88	YEAR89	YEAR90
771	UNION CARBIDE CORP	WV	UNION CARBIDE CHEMICALS & PLASTICS CO. INC.	689969	728806	868871
772	UNION CARBIDE CORP	LA	UNION CARBIDE CORP. STAR PLANT	0	0	68535
773	UNION CARBIDE CORP	LA	UNION CARBIDE INDUSTRIAL CHEMICALS	935223	0	202900
774	UNION CARBIDE CORP	LA	AMERCHOL CORP.	572	572	572
775	UNION CARBIDE CORP	TX	UNION CARBIDE CHEMICALS & PLASTICS CO. MARINE TERMINAL	145317	153123	161143
776	UNION CARBIDE CORP	TX	UNION CARBIDE CHEMICALS & PLASTICS CO. TEXAS CITY PLT.	0	646969	376667
777	UNION CARBIDE CORP	TX	UNION CARBIDE CHEMICALS PLASTICS CO. SEADRIFT PLANT	1154243	1199998	940807
778	UNION OIL CO	TX	UNION OIL OF CALIFORNIA DBA UNOCAL	184662	459310	0
779	UNION TEXAS PETROLEUM HOLDINGS	LA	UNION TEXAS PRODUCTS CORP. GEISMAR ETHYLENE PLANT	34050	116200	124360
780	UNIROYAL CHEMICAL CO INC	CT	UNIROYAL CHEMICAL CO. INC.	88646	95378	85310
781	UNIROYAL CHEMICAL CO INC	OH	UNIROYAL CHEMICAL CO. INC.	119009	73500	64618
782	UNIROYAL CHEMICAL CO INC	LA	UNIROYAL CHEMICAL CO. INC.	220423	374213	263310
783	UNITED ORGANICS CORP	NC	UNITED ORGANICS CORP.	0	3850	0
784	UNITEX CHEMICAL CORP.	NC	UNITEX CHEMICAL CORP.	104579	164734	91848
785	UDP	IL	UDP	91301	51862	49338
786	UDP	LA	UDP SHREVEPORT PLANT	11250	4900	3450
787	UPJOHN CO.	CT	UPJOHN CO. FINE CHEMICAL DIV.	70430	37313	20000
788	VANDENARK CHEMICAL CO INC	NY	VANDENARK CHEMICAL CO. INC.	2	1	0
789	VELSICOL CHEMICAL CORP.	TX	VELSICOL CHEMICAL CORP.	370834	383170	289581
790	VELSICOL CHEMICAL CORP.	TX	VELSICOL CHEMICAL CORP.	275589	163240	49978
791	VELSICOL CHEMICAL CORP.	IL	VELSICOL CHEMICAL CORP.	552	0	0
792	VININGS INDUSTRIES INC.	GA	VININGS INDUSTRIES INC.	2500	3519	4150
793	VISTA CHEMICAL CO.	ND	VISTA CHEMICAL CO.	92600	66650	65200
794	VISTA CHEMICAL CO.	MS	VISTA POLYMERS INC. VISTA POLYMERS DIV.	76812	76712	63993
795	VISTA CHEMICAL CO.	LA	VISTA CHEMICAL CO. LAKE CHARLES CHEMICAL COMPLEX	671700	630713	581338
796	VULCAN MATERIALS COMPANY	KS	VULCAN CHEMICALS	1156858	786659	528307
797	W. R. GRACE & CO.	NH	W. R. GRACE & CO.- CONN. ORGANIC CHEMICALS DIV.	7504	8464	3167
798	W. R. GRACE & CO.	TX	W. R. GRACE & CO. DEER PARK FACILITY	81338	71825	15334
799	WACKER SILICONES CORP.	NI	WACKER SILICONES CORP.	8700	9650	9405
800	WAKO CHEMICALS USA INC.	VA	WAKO CHEMICALS USA INC.	0	0	4540
801	WASHINGTON CHEMICAL INC.	WA	WASHINGTON CHEMICAL INC.	0	0	45
802	WERNER G. SMITH INC.	OH	WERNER G. SMITH INC.	0	500	500
803	WESTERN TAR PRODUCTS CORP.	TX	WESTERN TAR PRODUCTS CORP.	1500	1000	500
804	WESTERN TAR PRODUCTS CORP.	IN	WESTERN TAR PRODUCTS CORP.	2500	3700	1500
805	WHITE CHEMICAL CORP.	NJ	WHITE CHEMICAL CORP.	1954	2901	0
806	WITCO CORP.	NJ	WITCO CORP. HUNKO CHEMICAL DIV.	480	405	275
807	WITCO CORP.	NJ	WITCO CORP. ORGANICS DIV.	3909	3872	5637
808	WITCO CORP.	NJ	WITCO CORP. ARGUS DIV.	3865	4184	606
809	WITCO CORP.	NY	ARGUS DIV.	3550	3200	3200
810	WITCO CORP.	TX	WITCO CORP. HUNKO CHEMICAL DIV.	10058	47291	16224
811	WITCO CORP.	IL	WITCO CORP.	30935	16536	10452
812	WITCO CORP.	LA	WITCO CORP. ARGUS CHEMICAL DIV.	3378	16944	15827
813	WITCO CORP.	LA	WITCO CORP.	22699	32335	17583
814	WITCO CORP.	TX	WITCO CORP.	4165	2320	2310
815	WITCO CORP.	CA	WITCO CORP. ORGANICS DIV.	235	351	2005
816	WITCO CORP.	CA	U. S. PEROXYGEN	480	0	0
817	WRIGHT CHEMICAL CORP.	NC	WRIGHT CHEMICAL CORP.	829295	583564	574773
818	ZALCON INC.	OH	ZALCON INC.	0	0	0
819	ZIEGLER CO. INC.	WI	WASTE RESEARCH & RECLAMATION CO. INC.	20998	0	0
				=====	=====	=====
				152669905	153636668	134677303

§63.183 List of volatile hazardous air pollutants.

<u>CHEMICAL NAME</u>	<u>CAS NUMBER</u>
Acetaldehyde	75070
Acetamide	60355
Acetonitrile	75058
Acetophenone	98862
2-Acetylaminofluorine	53963
Acrolein	107028
Acrylamide	79061
Acrylic acid	79107
Acrylonitrile	107131
Allyl chloride	107051
4-Aminobiphenyl	92671
Aniline	62533
o-Anisidine	90040
Benzene	71432
Benzidine	92875
Benzotrichloride	98077
Benzyl chloride	100447
Biphenyl	92524
Bis(2-ethylhexyl)phthalate (DEHP)	117817
Bis(chloromethyl)ether	542881
Bromoform	75252
1,3-Butadiene	106990
Caprolactam	105602
Carbon disulfide	75150
Carbon tetrachloride	56235
Carbonyl sulfide	463581
Catechol•	120809
Chloroacetic acid	79118
2-Chloroacetophenone	532274
Chlorobenzene	108907
Chloroform	67663
Chloromethyl methyl ether	107302
Chloroprene	126998

Cresols and cresylic acids (mixed)	1319773
Cresol and cresylic acid (o-isomer)	95487
Cresol and cresylic acid (m-isomer)	108394
Cresol and cresylic acid (p-isomer)	106445
Cumene	98828
2,4-D, salts and esters	94757
DDE	3547044
Diazomethane	334883
Dibenzofurans	132649
1,2-Dibromo-3-chloropropane	96128
Dibutylphthalate	84742
1,4-Dichlorobenzene(p-)	106467
3,3'-Dichlorobenzidine	91941
Dichloroethyl ether (bis(2-chloroethyl)ether)	111444
1,3-Dichloropropene	542756
Diethanolamine	111422
N,N-Dimethylaniline	121697
Diethyl sulfate	64675
3,3'-Dimethoxybenzidine	119904
Dimethyl aminoazobenzene	60117
3,3'-Dimethylbenzidine	119937
Dimethyl carbamoyl chloride	79447
Dimethylformamide	68122
1,1-Dimethylhydrazine	57147
Dimethyl phthalate	131113
Dimethyl sulfate	77781
4,6-Dinitro-o-cresol, and salts	534521
2,4-Dinitrophenol	51285
2,4-Dinitrotoluene	121142
1,4-Dioxane (1,4-Diethyleneoxide)	123911
1,2-Diphenylhydrazine	122667
Epichlorohydrin (1-Chloro-2,3-epoxypropane)	106898
1,2-Epoxybutane	106887
Ethyl acrylate	140885
Ethylbenzene	100414

Ethyl carbamate (Urethane)	51796
Ethyl chloride (Chloroethane)	75003
Ethylene dibromide (Dibromoethane)	106934
Ethylene dichloride (1,2-Dichloroethane)	107062
Ethylene glycol	107211
Ethylene oxide	75218
Ethylene thiourea	96457
Ethylidene dichloride (1,1-Dichloroethane)	75343
Formaldehyde	50000
Glycol ethers ^a	0
Hexachlorobenzene	118741
Hexachlorobutadiene	87683
Hexachloroethane	67721
Hexamethylene-1,6-diisocyanate	822060
Hexamethylphosphoramide	680319
Hexane	110543
Hydrazine	302012
Hydroquinone	123319
Isophorone	78591
Maleic anhydride	108316
Methanol	67561
Methyl bromide (Bromomethane)	74839
Methyl chloride (Chloromethane)	74873
Methyl chloroform (1,1,1-Trichloroethane)	71556
Methyl ethyl ketone (2-Butanone)	78933
Methyl hydrazine	60344
Methyl iodide (Iodomethane)	74884
Methyl isobutyl ketone (Hexone)	108101
Methyl isocyanate	624839
Methyl methacrylate	80626
Methyl tert butyl ether	1634044
4,4-Methylene bis(2-chloroaniline)	101144
Methylene chloride (Dichloromethane)	75092
Methylene diphenyl diisocyanate (MDI)	101688
4,4'-Methylenedianiline	101779

Naphthalene	91203
Nitrobenzene	98953
4-Nitrobiphenyl	92933
4-Nitrophenol	100027
2-Nitropropane	79469
N-Nitroso-N-methylurea	684935
N-Nitrosodimethylamine	62759
N-Nitrosomorpholine	59892
Phenol	108952
p-Phenylenediamine	106503
Phosgene	75445
Phthalic anhydride	85449
Polychlorinated biphenyls (Aroclors)	1336363
1,3-Propane sultone	1120714
beta-Propiolactone	57578
Propionaldehyde	123386
Propoxur (Baygon)	114261
Propylene dichloride (1,2-Dichloropropane)	78875
Propylene oxide	75569
1,2-Propylenimine (2-Methyl aziridine)	75558
Quinone	106514
Styrene	100425
Styrene oxide	96093
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746016
1,1,2,2-Tetrachloroethane	79345
Tetrachloroethylene (Perchloroethylene)	127184
Toluene	108883
2,4-Toluene diamine	95807
2,4-Toluene diisocyanate	584849
o-Toluidine	95534
1,2,4-Trichlorobenzene	120821
1,1,2-Trichloroethane	79005
Trichloroethylene	79016
2,4,5-Trichlorophenol	95954
2,4,6-Trichlorophenol	88062

Triethylamine	121448
Trifluralin	1582098
2,2,4-Trimethylpentane	540841
Vinyl acetate	108054
Vinyl bromide	593602
Vinyl chloride	75014
Vinylidene chloride (1,1-Dichloroethylene)	75354
Xylenes (not otherwise specified)	1330207
Xylene (o-isomer)	95476
Xylene (m-isomer)	108383
Xylene (p-isomer)	106423

APPENDIX C

APPENDIX C

EVALUATION OF THE MULTIMEDIA
IMPACTS OF THE HAZARDOUS
ORGANIC NESHAP (HON)

for:

Chemical Manufacturers Association
2501 M Street, NW
Washington, D.C. 20037

by:

Environmental Quality Management, Inc.
1310 Kemper Meadow Drive
Cincinnati, Ohio 45240

April 1993

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SECTION 1

INTRODUCTION

On December 31, 1992, U. S. Environmental Protection Agency (EPA) published a proposed rule in the Federal Register for regulating the emissions of certain organic hazardous air pollutants from synthetic organic chemical manufacturing industry (SOCMI) production processes which are part of major sources under Section 112 of the Clean Air Act. The proposed rule, referred to as the hazardous organic NESHAP or the HON, would require implementation of control measures that are defined as maximum achievable control technology (MACT) for certain sources. Five source types in the SOCMI are affected by the proposed rule; these are:

- Storage tanks
- Process vents
- Equipment leaks
- Wastewater collection and treatment operations
- Transfer loading operations

With the exception of the equipment leaks source category, the proposed rule requires add-on controls for the affected sources. The background information document (BID) for the proposed HON rule provides the basis and performs impacts assessment for the affected sources.

Environmental Quality Management, Inc. (EQ) has been contracted by the Chemical Manufacturers Association (CMA) to evaluate the multimedia impacts of the HON for the SOCMI source categories. The project scope consists of examining the BID to understand and critique EPA's basis and assumptions in its evaluation of multimedia impacts, and quantifying multimedia impacts for the affected source categories.

This report documents the methodology and multimedia impacts of the proposed HON regulations. The analysis addresses the source categories of process vents, transfer and loading operations, and wastewater collection and treatment operations. The reference control technology (RCT) for the storage tank source category consists of floating roof related technology that does not generate secondary emissions, and thus it is not included in the analysis. The ap-

proach used for the evaluation of the multimedia impacts along with the source sizes used as a basis for evaluation is presented and impacts of the RCT identified by EPA are presented. Section 2 of the report provides the regulations overview and identifies the NO_x and CO impacts for the model plants. Section 3 identifies the multimedia impacts associated with the halogenated gas streams. The cost-effectiveness of controlling NO_x emissions from the thermal oxidizer systems is discussed in Section 4. The study conclusions are presented in Section 5.

SECTION 2

REGULATORY REVIEW AND IDENTIFICATION OF MULTIMEDIA IMPACTS

Multimedia impacts associated with the RCTs for three HON source categories (process vents, transfer and loading operations; and wastewater collection and treatment operations) are discussed in this report. These source categories require installation of add-on control systems that generate emissions of nitrogen oxides (NO_x) and carbon monoxide (CO). The MACT for the process vents and transfer and loading operations has been defined as installation of thermal oxidizer systems. The MACT for the wastewater collection and treatment operations has been defined as installation of steam stripper system. The NO_x and CO emissions are regulated by EPA and the states where SOCMI plants are located. Any increase in the NO_x and CO emissions must be analyzed for their regulatory impacts. This analysis identifies the regulations that must be complied with and quantifies the NO_x and CO emissions for the model plant sizes defined by CMA and EPA.

2.1 SUMMARY OF NO_x AND CO REGULATIONS

The review of the geographic distribution of the SOCMI process units indicates that 17 states account for 90 percent of the total SOCMI process units in the United States. Table 1, based on the data available in the BID, indicates the states that comprise 90 percent of the SOCMI process unit capacity. The regulatory evaluation of the NO_x and CO emissions for the three SOCMI source categories was performed for the 17 states identified in Table 1.

Table 2 identifies the CO, NO_x, and ozone nonattainment areas for the 17 states listed in Table 1. No areas in the 17 states are currently identified as nonattainment for NO_x, however, the NO_x emissions will be covered under ozone attainment status since NO_x has been identified as a precursor to ozone. The definition of the nonattainment areas is based on the Clean Air Act (CAA) amended on November 15, 1990. The CAA specifies design values for ozone and deadlines for attaining the ozone standards.

2.2 EMISSION RATES

To facilitate the evaluation of the multimedia impacts, model plants were defined for each of the three source categories. Table 3 shows the model plant parameters used for evaluating the multimedia impacts.

NO_x and CO emission rates were estimated for the model plants identified in Table 3. The NO_x emission rates for the incineration systems were based on a NO_x concentration of 150 ppm in the exhaust stream. EQ contacted burner manufacturers and reviewed in-house data to determine the representative NO_x concentration for the exhaust streams controlled by incinerators. The NO_x concentration depends upon the type of burner and also varies from manufacturer to manufacturer. Regulation of NO_x by EPA has lead to design of low NO_x burners by manufacturers. NO_x levels under 100 ppm can be achieved by the current burner designs. Some vendors can guarantee NO_x levels under 50 ppm. The CO emissions were based on the data available in the BID.

For the process vent model plants, SO₂ emission rates associated with the electrical energy requirement were also calculated. Electrical energy requirement for the model plants was based on a system pressure drop of 20 inches of water and annual operating hours of 8760. A heat rate of 10,000 Btu/kWh was used to estimate the coal consumption associated with the electrical energy required to operate the incinerator system. The annual SO₂ emissions were based on a SO₂ emission rate of 1.2 lb/10⁶ Btu heat input. These parameters formed the basis for evaluation of the regulatory impacts.

Table 4 shows the NO_x and CO emission rates for the 4 process vent model plants defined by CMA. The NO_x and CO emission rates for the 12 model plants included in the BID were also calculated and are summarized in Table 5. The SO₂ emission rates associated with the electrical energy required to operate the incinerator are shown in Table 6.

Table 7 summarizes the secondary impacts for the model loading racks streams. The secondary impacts for the wastewater model plants are summarized in Table 8.

2.3 NEW SOURCE REVIEW IMPACTS

Plants which choose to install incineration to satisfy RCT requirements for affected process vents may be faced with additional regulatory requirements for permitting under CAA Title I, Parts C and D. Part C, Title I provides requirements for new source review (NSR) for major sources located in attainment areas. The implementing regulations are provided at 40 CFR 52.21, and are commonly referred to as Prevention of Significant Deterioration (PSD). New source review for major sources in nonattainment areas is governed by Part D, Title I and Appendix S to 40 CFR Part 51.

Under both PSD and nonattainment NSR, the retrofit of a fume incinerator for control and reduction of VOC emissions to satisfy HON RCT requirements would be defined as a modification due to increased emissions of NO_x and CO. Applicability to either regulation would depend upon the potential levels of these emissions from operation of the incineration unit. Secondary NO_x and CO emissions resulting from installation of incineration to control process vent HON emissions for Model Plant Nos. 1, 2, and 3 (see Table 4) were evaluated as to their applicability under each regulatory program.

PSD --

A stationary source (i.e., chemical process plant) is defined as major if potential emissions of any pollutant for which that area is designated as attainment exceeds 100 tpy. If the facility evaluated as Model Plant Nos. 1, 2, or 3 was a major stationary source, the retrofit project must be evaluated to determine if it would be considered a major modification. As summarized in Table 4, the significant net emissions increase levels for NO_x and CO under PSD are 40 and 100 tpy, respectively. From Table 4 it can be observed that Model Plant No. 1, 2, or 3 CO emissions would not trigger PSD review. Emissions of NO_x from Model Plant Nos. 1 and 2 would not trigger PSD review; however, the retrofit project at Model Plant No. 3 would invoke PSD review as a major modification. The estimated NO_x emission rate (161 Mg/yr, 177 tpy) exceeds the PSD de minimis rate of 40 tpy.

Model Plant No. 3 would also invoke PSD review if the facility were defined as a minor source before the project. The retrofit project at Model Plant

No. 3 (potential of 177 tpy of increased NO_x emissions) would by itself be defined as a major source and subject to PSD review.

Among the requirements of PSD are:

- The facility must employ best available control technology (BACT) to control NO_x from the project. [BACT is representative of the most stringent level of emission control with consideration given to economic, energy and environmental impacts.]
- Air quality impacts from the modification must be protective of PSD-defined air quality increments and the National Ambient Air Quality Standards.
- Secondary impacts due to the modification (e.g., impacts on soils, vegetation, visibility, demographics) must be assessed.
- Unless exempted, the facility must collect one year of ambient air quality monitoring data.

NONATTAINMENT NSR --

Title I of the 1990 CAA Amendments revised major stationary source and major modification definitions for ozone precursor (VOC and NO_x) and CO emissions. If the facility (including all actively emitting operations) is considered a major stationary source for ozone (i.e., potential facility-wide VOC or NO_x emissions greater than levels given in Table 9), when seeking a permit modification for the control equipment retrofit project, the facility will be forced to comply with major nonattainment NSR requirements if the project involves a significant increase in NO_x emissions. If the facility is presently a minor source, the project itself would have to represent a major source of NO_x to be subject to major nonattainment NSR. A similar analysis is applicable to potential CO emissions increases.

From Table 4 it can be observed that Model Plant No. 1, 2, or 3 CO emissions would not trigger nonattainment NSR. The maximum projected CO emissions increases from the three examples (26 Mg/yr, 29 tpy) are well below the lowest trigger level (i.e., 50 tpy for Serious CO nonattainment areas).

The model plant NO_x emissions increases are affected differently depending upon the area (based upon ozone nonattainment classification, see Table 2) in which the plant is located. The modification represented by Model Plant No. 3 would trigger nonattainment NSR if located in any ozone nonattainment area regardless of location and classification. Model Plant No. 3 would also trigger

review if the facility was a minor source prior to the project because it alone represents a major stationary source. Model Plant Nos. 1 and 2 would only trigger nonattainment NSR as a modification in the Extreme ozone nonattainment area.

Among the requirements of the major nonattainment NSR program are:

- The facility must employ lowest achievable emission rates (LAER) to control NO_x from the project. [LAER is representative of the most stringent level of emission control without regard for economical considerations.]
- The facility would be required to locate and secure NO_x emission reductions (offsets) from any other facility operations or from nearby facilities at a ratio summarized in Table 9.
- The offsets secured by the facility must provide for a net air quality benefit.
- The owner/operator of the facility must demonstrate that all other major stationary sources owned by them within the State are subject to and in compliance with all applicable parts of the Clean Air Act.

2.4 NO_x AND CO REGULATORY IMPACTS FOR MODEL PLANTS

The above sections provided a detailed discussion of regulatory issues for NO_x and CO emissions from the thermal oxidizer systems. Tables 2 and 3 summarized the regulatory applicability for the process vent model plants. Based on Tables 2 and 3, Tables 10 and 11 summarize the regulatory applicability for the existing minor source and major source, respectively. For each model plant, the attainment and nonattainment permitting issues are indicated for CO and NO_x.

SECTION 3

IMPACT EVALUATION FOR HALOGENATED STREAMS

Section 2 evaluation consisted of identification of multimedia impacts associated with the RCTs for three HON source categories (process vents, transfer and loading operations, and wastewater collection and treatment operations). This section evaluates the multimedia impacts associated with halogenated exhaust streams.

Treatment of halogenated gas streams via thermal oxidation generates gaseous hydrogen chloride. A combination thermal oxidizer/scrubber system will be required to control the halogenated exhaust streams. Operation of the scrubber will generate a wastewater stream that will require treatment and disposal. The scrubber will also require electrical energy for the pumps and pressure drop in the system. Table 12 presents the water rate data for the scrubber system for the process vent model plants. The rates are based on a liquid-to-gas ratio (gallons/1,000 scf) of 20 and a make-up water rate of 10 percent.

The operation of the scrubber will generate a low pH wastewater discharge that will require treatment and disposal. However, the disposal needs will depend upon the characteristics of the other wastewater streams present at the facility where model plant streams are present and treatment methods practiced at the facility.

SECTION 4

COST-EFFECTIVENESS OF NO_x CONTROL

As outlined in Section 2, NO_x emissions generated by thermal oxidizer systems proposed as MACT must be controlled to comply with the CAA regulations. The costs of controlling NO_x generated by the thermal oxidizer systems for the CMA process vent model plants have been estimated to determine the NO_x control cost-effectiveness.

The NO_x present in the exhaust stream from the thermal oxidizer system is generated as "thermal NO_x", i.e., nitrogen and oxygen present in the combustion air react to produce NO_x. The NO_x reduction approaches for thermal oxidizer systems consist of burner and combustion process modification. Post-combustion or add-on NO_x control systems such as selective catalytic reduction or selective noncatalytic reduction are not practical for exhaust streams from thermal oxidizer systems because of the system complexity and costs. The applicability of the post-combustion NO_x control methods is also questionable for the thermal oxidizer exhaust stream because of the relatively low NO_x concentration level.

Low-NO_x burner design is a primary method of NO_x reduction available for the thermal oxidizer systems. This approach can also be combined with other measures such as exhaust gas recirculation and/or staged combustion. The specific modification employed will depend on the characteristics of the VOC-laden stream that is being controlled.

Table 13 presents the cost-effectiveness of the NO_x control measures for the thermal oxidizer systems for the process vent model plants. The cost evaluation is based on the assumption that the NO_x from thermal oxidizer system will be reduced by about 66 percent (from uncontrolled level of 150 ppm to 50 ppm) using a combination of low-NO_x burner design and combustion modification measures. Based on EQ's experience, it is estimated that the NO_x reduction measures will increase the capital cost of the equipment by about 20 percent. Using this assumption cost-effectiveness values for the process vent model plants are presented in Table 13.

Table 13 assumes that a single thermal oxidizer unit will be installed to handle the exhaust flow from each model plant. Although this assumption may be appropriate for the smaller model plants (1 and 2), larger model plants may require multiple systems for process control reasons. The cost-effectiveness of NOx control ranges from \$1,300 to \$22,300/Mg-yr of NOx controlled. Again, the costs of Model Plants 3 and 4 would be significantly higher since they will require installation of multiple thermal oxidizer units. NOx cost-effectiveness values of \$8,000/Mg-yr or higher are more realistic for the larger plants. The HAP cost-effectiveness values for the model plants are also shown in Table 13. The HAP cost-effectiveness values are significantly lower than the NOx cost effectiveness values.

SECTION 5

CONCLUSIONS

The analysis performed in this memo leads to following conclusions:

- Control of process vent source category model plants as defined by CMA results in significant quantities of NO_x, CO, and SO₂ emissions.
- The electrical energy requirements for the CMA process vent model plants 3 and 4 are significant and result in significant SO₂ emissions.
- The NO_x and CO emission rates for the loading rack and wastewater treatment sources are relatively minor.
- The HAP cost-effectiveness values are significantly lower than the NO_x cost effectiveness values.

TABLE 1. STATES COMPRISING 90 PERCENT OF THE SOCMI CAPACITY

State	Number of process units	Percent of national total
Texas	251	34
Louisiana	115	16
New Jersey	56	8
West Virginia	33	5
Illinois	26	4
North Carolina	20	3
Tennessee	18	2
Kentucky	17	2
Michigan	17	2
Pennsylvania	16	2
Alabama	15	2
California	15	2
Kansas	14	2
Ohio	14	2
New York	13	2
Indiana	9	1
South Carolina	8	1
	657	90
National Total	729	100

TABLE 2. SUMMARY OF NONATTAINMENT AREAS BY STATE

State	Carbon Monoxide		Nitrogen Dioxide Area	Ozone	
	Area	Class		Area	Class
Texas	Portion of the City of El Paso (El Paso County)	Moderate ≤ 12.7 ppm	(none)	Beaumont-Port Arthur area Hardin County Jefferson County Orange County Dallas-Fort Worth area Collin County Dallas County Denton County Tarrant County El Paso County Houston-Galveston-Brazoria area Brazoria County Chambers County Fort Bend County Galveston County Harris County Liberty County Montgomery County Waller County Victoria County	Serious Serious Serious Moderate Moderate Moderate Moderate Serious Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 (Incomplete)
Louisiana	(none)		(none)	Baton Rouge Area Ascension Parish East Baton Rouge Parish Iberville Parish Livingston Parish Pointe Coupee Parish West Baton Rouge Parish Beauregard Parish Grant Parish Lafayette Parish Lafourche Parish Calcasieu Parish New Orleans area Jefferson Parish Orleans Parish St. Bernard Parish St. Charles Parish St. James Parish St. Mary Parish	 Serious Serious Serious Serious Serious Serious (Incomplete) (Incomplete) Transitional (Incomplete) Marginal Transitional Transitional Transitional (Incomplete) (Incomplete)
New Jersey	City of Atlantic City (Atlantic County) City of Burlington (Burlington County) Borough of Freehold (Monmouth County) City of Morristown (Morristown County) Bergen, Essex, Hudson, Union Counties Cities of Clifton, Patterson, Passaic (Passaic County) Portion of the Borough of Penns Grove (Salem County) City of Perth Amboy (Middlesex County) Camden County Borough of Somerville (Somerset County) City of Toms River (Ocean County) City of Trenton (Mercer County)	Not Classified Not Classified Not Classified Not Classified Moderate > 12.7 ppm Moderate > 12.7 ppm Not Classified Not Classified Moderate ≤ 12.7 ppm Not Classified Not Classified Not Classified	(none)	Warren County Atlantic County Cape May County New York-N. New Jersey-Long Island area Bergen County Essex County Hudson County Hunterdon County Middlesex County Monmouth County Morris County Ocean County	Marginal Moderate Moderate Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17

TABLE 2. SUMMARY OF NONATTAINMENT AREAS BY STATE

State	Carbon Monoxide		Nitrogen Dioxide	Ozone	
	Area	Class	Area	Area	Class
				Passaic County	Severe-17
				Somerset County	Severe-17
				Sussex County	Severe-17
				Union County	Severe-17
				Philadelphia-Wilmington-Trenton Area	
				Burlington County	Severe-15
				Camden County	Severe-15
				Cumberland County	Severe-15
				Gloucester County	Severe-15
				Mercer County	Severe-15
West Virginia	(none)		(none)	Salem County	Severe-15
				Kanawha County	Moderate
				Putnam County	Moderate
				Greenbrier County	Marginal
				Cabell County	Moderate
				Wayne County	Moderate
				Wood County	Moderate
Illinois	(none)		(none)	Chicago-Gary-Lake County Area:	
				Cook County	Severe-17
				Du Page County	Severe-17
				Aux Sable, Gooselake Townships (Grundy County)	Severe-17
				Kane County	Severe-17
				Oswego Township (Kendall County)	Severe-17
				Lake County	Severe-17
				McHenry County	Severe-17
				Will County	Severe-17
				Jersey County	Marginal
				St. Louis Area:	
				Madison County	Moderate
				Monroe County	Moderate
				St. Clair County	Moderate
North Carolina	Mecklenburg County Durham County Wake County Forsyth County	Not Classified Moderate ≤ 12.7 ppm Moderate ≤ 12.7 ppm Moderate ≤ 12.7 ppm	(none)	Gaston County	Moderate
				Mecklenburg County	Moderate
				Davidson County	Moderate
				Portion of Davie County	Moderate
				Forsyth County	Moderate
				Guilford County	Moderate
				Durham County	Moderate
				Dutchville Township (Granville County)	Moderate
				Wake County	Moderate
Tennessee	Shelby County	Moderate ≤ 12.7 ppm	(none)	Knox County	Marginal
				Shelby County	Marginal
				Nashville Area:	
				Davidson County	Moderate
				Rutherford County	Moderate
				Sumner County	Moderate
				Williamson County	Moderate
				Wilson County	Moderate

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TABLE 2. SUMMARY OF NONATTAINMENT AREAS BY STATE

State	Carbon Monoxide		Nitrogen Dioxide	Ozone	
	Area	Class	Area	Area	Class
Pennsylvania				Bay County	(Incomplete)
				Midland County	(Incomplete)
				Saginaw County	(Incomplete)
				Sanilac County	(Incomplete)
				Shiawassee County	(Incomplete)
				St. Joseph County	(Incomplete)
				Tuscola County	(Incomplete)
				Van Buren County	(Incomplete)
	Portions of the City of Philadelphia (Phil. County)	Moderate ≤ 12.7 ppm	(none)	Allentown-Bethlehem-Easton Area:	
	Portions of the City of Pittsburgh (Allegheny County)	Not Classified		Carbon County	Marginal
				Lehigh County	Marginal
				Northampton County	Marginal
				Blair County	Marginal
				Crawford County	(Incomplete)
				Erle County	Marginal
				Franklin County	(Incomplete)
				Greene County	(Incomplete)
				Harrisburg-Lebanon-Carlisle Area:	
				Cumberland County	Marginal
				Dauphin County	Marginal
				Lebanon County	Marginal
				Perry County	Marginal
				Johnstown Area:	
				Cambria County	Marginal
				Somerset County	Marginal
				Juniata County	(Incomplete)
				Lancaster County	Marginal
				Lawrence County	(Incomplete)
				Northumberland	(Incomplete)
				Philadelphia-Wilmington-Trenton Area:	
				Bucks County	Severe-15
				Chester County	Severe-15
				Delaware County	Severe-15
				Montgomery County	Severe-15
				Philadelphia County	Severe-15
				Pike County	(Incomplete)
				Pittsburgh-Beaver Valley Area:	
				Allegheny County	Moderate
				Armstrong County	Moderate
				Beaver County	Moderate
				Butler County	Moderate
				Fayette County	Moderate
				Washington County	Moderate
				Westmoreland County	Moderate
				Berks County	Moderate
				Schuylkill County	(Incomplete)
				Scranton-Wilkes Barre Area:	
				Columbia County	Marginal
				Lackawanna County	Marginal
				Luzerne County	Marginal
				Monroe County	Marginal
				Wyoming County	Marginal
				Snyder County	(Incomplete)

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TABLE 2. SUMMARY OF NONATTAINMENT AREAS BY STATE

State	Carbon Monoxide		Nitrogen Dioxide	Ozone	
	Area	Class	Area	Area	Class
Kansas	(none)		(none)	Ventura County	Severe-15
				Yuba City Area: Portions of Sutter County Yuba County	Transitional Transitional
Ohio	Cuyahoga County	Moderate ≤ 12.7 ppm	(none)	(none)	
New York	New York-North New Jersey-Long Island Area: Bronx County Kings County Nassau County New York County Queens County Richmond County Westchester County Onondaga County	Moderate > 12.7 ppm Moderate > 12.7 ppm Moderate > 12.7 ppm Moderate > 12.7 ppm Moderate > 12.7 ppm Moderate > 12.7 ppm Moderate > 12.7 ppm Moderate ≤ 12.7 ppm	(none)	Stark County	Marginal
				Cincinnati-Hamilton Area: Butler County	Moderate
				Clermont County	Moderate
				Hamilton County	Moderate
				Warren County	Moderate
				Cleveland-Akron-Lorain Area: Ashtabula County	Moderate
				Cuyahoga County	Moderate
				Geauga County	Moderate
				Lake County	Moderate
				Lorain County	Moderate
				Medina County	Moderate
				Portage County	Moderate
				Summit County	Moderate
				Clinton County	Transitional
				Columbiana County	(Incomplete)
				Columbus Area: Delaware County	Marginal
				Franklin County	Marginal
				Licking County	Marginal
				Dayton-Springfield Area: Clark County	Moderate
				Greene County	Moderate
				Miami County	Moderate
				Montgomery County	Moderate
				Preble County	Transitional
				Jefferson County	Transitional
				Toledo Area: Lucas County	Moderate
				Wood County	Moderate
				Youngstown-Warren-Sharon Area: Mahoning County	Marginal
				Trumbull County	Marginal
				Albany-Schenectady-Troy Area: Albany County	Marginal
				Greene County	Marginal
				Montgomery County	Marginal
				Rensselaer County	Marginal
				Saratoga County	Marginal
				Schenectady County	Marginal
				Buffalo-Niagara Falls Area: Erie County	Marginal
				Niagara County	Marginal
				Portions of Essex County	Rural Transport
				Jefferson County	

TABLE 2. SUMMARY OF NONATTAINMENT AREAS BY STATE

State	Carbon Monoxide		Nitrogen Dioxide Area	Ozone	
	Area	Class		Area	Class
Indiana	Portions of the City of East Chicago (Lake County) Portions of the City of Indianapolis (Marion County)	Not Classified Not Classified	(none)	New York-North New Jersey-Long Island Area: Bronx County Kings County Nassau County New York County Orange County Putnam County Queens County Richmond County Rockland County Suffolk County Westchester County Dutchess County	Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Severe-17 Marginal
				Chicago-Gary-Lake County Area: Lake County Porter County Vanderburgh County Marion County Louisville Area: Clark County Floyd County South Bend-Elkhart Area: Elkhart County St. Joseph County	Severe-17 Severe-17 Marginal Marginal Moderate Moderate Marginal Marginal
South Carolina	(none)		(none)	Cherokee County	Marginal

TABLE 3. MODEL PLANT PARAMETERS FOR THE HON SOURCE CATEGORIES

Source Category	Model Plant Parameters
1. Process vents	1. Stream flow rate = 100 scmm HAP = hexane HAP concentration = 299 ppmv 2. Stream flow rate = 1000 scmm HAP = hexane HAP concentration = 116 ppmv 3. Stream flow rate = 10,000 scmm HAP = hexane HAP concentration = 98 ppmv 4. Stream flow rate = 100,000 scmm HAP = hexane HAP concentration = 96 ppmv
2. Transfer and loading operations	20 model plants defined in the BID
3. Wastewater collection and treatment operations	18 model plants defined in the BID

TABLE 4. SECONDARY IMPACTS FOR INCINERATION CONTROL OF CMA MODEL PROCESS VENT STREAMS

Model Plant No.	Source Description	Control Device	HAP Emissions			Secondary NOX		Secondary CO	
			Uncontrolled, Mg/yr	Controlled, Mg/yr	Reduction, Mg/yr	Emissions, Mg/yr	NOX-to-HAP Ratio	Emissions, Mg/yr	CO-to-HAP Ratio
1	100 scmm flow with 299 ppmv hexane as only VOC	Thermal Incineration	51.75	1.04	51	1.48	0.029	0.260	0.005
2	1,000 scmm flow with 116 ppmv hexane as only VOC	Thermal Incineration	202	4.04	198	16.0	0.081	2.34	0.012
3	10,000 scmm flow with 98 ppmv hexane as only VOC	Thermal Incineration	1,697	33.9	1,663	161	0.097	26.0	0.016
4	100,000 scmm flow with 96 ppmv hexane as only VOC	Thermal Incineration	16,625	333	16,293	1610	0.099	260	0.016

TABLE 5. SECONDARY IMPACTS FOR INCINERATION CONTROL OF EPA MODEL PROCESS VENT STREAMS

Model Plant No.	Source Description	Control Device	HAP Emissions			Secondary NOX		Secondary CO	
			Uncontrolled, Mg/yr	Controlled, Mg/yr	Reduction, Mg/yr	Emissions, Mg/yr	NOX-to-HAP Ratio	Emissions, Mg/yr	CO-to-HAP Ratio
1	Formaldehyde via Air Oxidation	Thermal Incineration	91.6 (a)	12.2	79 (a)	0.0316	0.0004 (a)	0.00394	0.00005 (a)
2	Air Oxidation	Thermal Incineration	2770	55.4	2715	355	0.131	23.4	0.0086
3	Phthalic Anhydride via Air Oxidation	Thermal Incineration	876 (a)	117	759 (a)	3.66	0.0048 (a)	0.455	0.0006 (a)
4	Perephthalic Acid via Air Oxidation	Thermal Incineration	6100	122	5978	624.9	0.105	18.8	0.0031
5	Distillation NV	Incinerator and Scrubber	8.46 (a)	1.69	6.8 (a)	0.000201	0.00003 (a)	0.0000249	0.000004 (a)
6	Distillation V	Thermal Incineration	6.36	0.127	6.23	0.186	0.030	0.0148	0.0024
7	Ethylbenzene	Flare	3.38	0.0676	3.31	0.0141	0.0043	0.0171	0.0052
8	Formaldehyde	Flare	0.139	0.00279	0.13621	0.0168	0.123	0.00675	0.0496
9	Adiponitrile via Hydrodimerization.	Thermal Incineration	92.2	1.84	90.4	5.26	0.058	0.408	0.0045
10	Ethylene Glycol Monoethyl Ether Acetate via Esterification	Flare	13.6	0.273	13.3	0.0153	0.0011	0.00632	0.0005
11	Halogenation	Incinerator and Scrubber	15	0.3	14.7	1.13	0.077	0.055	0.0037
12	Condensation	Flare	0.337	0.00675	0.330	0.0141	0.043	0.0059	0.0179

(a) These numbers are suspect. The uncontrolled HAP generation values were not calculated following the same calculation procedures as the other model plants emissions. Typographical errors suspected.

TABLE 6. ELECTRICAL ENERGY REQUIREMENTS AND SO₂ EMISSION RATES FOR THE PROCESS VENT MODEL PLANTS

Flow rate, scmm	Electricity rating, kW	Annual energy requirement, kWh/yr	Coal consumption, tpy	SO ₂ emission rate, tpy
100	14	121,000	50	1
1,000	138	1,213,000	505	7
10,000	1,384	12,127,000	5,053	73
100,000	13,843	121,268,000	50,528	728

TABLE 7. SECONDARY IMPACTS FOR INCINERATION CONTROL OF EPA MODEL LOADING RACK STREAMS

Model Rack No.	Model Description	Control Device	HAP Emissions			Secondary NOX		Secondary CO	
			Uncontrolled, Mg/yr	Controlled, Mg/yr	Reduction, Mg/yr	Emissions, Mg/yr	NOX-to-HAP Ratio	Emissions, Mg/yr	CO-to-HAP Ratio
1	Tank car rack with 3 arms handling 1 chemical; Max. through 0.00831 MMgal/yr; Avg. v.p. 0.210 mmHG	Flare	3.63E-06	7.30E-08	3.56E-06	2.25E-05	6.33E+00	9.01E-06	2.53E+00
2	Tank car rack with 3 arms handling 1 chemical; Max. through 0.0635 MMgal/yr; Avg. v.p. 1.00 mmHG	Thermal incinerator/scrubber	6.44E-04	1.29E-05	6.31E-04	3.62E-05	5.74E-02	7.37E-06	1.17E-02
3	Tank car rack with 3 arms handling 1 chemical; Max. through 0.300 MMgal/yr; Avg. v.p. 0.250 mmHG	Flare	1.45E-04	2.89E-06	1.42E-04	8.00E-05	5.63E-01	3.20E-05	2.25E-01
4	Tank car rack with 3 arms handling 4 chemicals; Max. through 4.65 MMgal/yr; Avg. v.p. 149 mmHG	Thermal incinerator/scrubber	3.14E-02	6.29E-04	3.08E-02	1.05E-02	3.41E-01	4.23E-04	1.37E-02
5	Tank car rack with 3 arms handling 1 chemical; Max. through 1.23 MMgal/yr; Avg. v.p. 6.59 mmHG	Flare	9.38E-02	1.88E-03	9.19E-02	2.91E-03	3.17E-02	1.16E-03	1.26E-02
6	Tank car rack with 16 arms handling 4 chemicals; Max. through 33.3 MMgal/yr; Avg. v.p. 889 mmHG	Thermal incinerator/scrubber	3.46E+00	6.91E-02	3.39E+00	1.88E-02	5.54E-03	3.60E-03	1.06E-03
7	Tank car rack with 8 arms handling 1 chemical; Max. through 12.9 MMgal/yr; Avg. v.p. 6.59 mmHG	Flare	9.83E-01	1.96E-02	9.63E-01	2.98E-02	3.09E-02	1.19E-02	1.24E-02

TABLE 7. SECONDARY IMPACTS FOR INCINERATION CONTROL OF EPA MODEL LOADING RACK STREAMS

Model Rack No.	Model Description	Control Device	HAP Emissions			Secondary NOX		Secondary CO	
			Uncontrolled, Mg/yr	Controlled, Mg/yr	Reduction, Mg/yr	Emissions, Mg/yr	NOX-to-HAP Ratio	Emissions, Mg/yr	CO-to-HAP Ratio
8	Tank car rack with 8 arms handling 2 chemicals; Max. through 16.5 MMgal/yr; Avg. v.p. 8.42 mmHG	Flare	1.71E+00	3.42E-02	1.68E+00	3.96E-02	2.36E-02	1.58E-02	9.43E-03
9	Tank car rack with 16 arms handling 4 chemicals; Max. through 45.6 MMgal/yr; Avg. v.p. 15.2 mmHG	Thermal incinerator	6.52E+00	1.30E-01	6.39E+00	1.26E-01	1.97E-02	2.53E-03	3.96E-04
10	Tank car rack with 10 arms handling 5 chemicals; Max. through 22.2 MMgal/yr; Avg. v.p. 327 mmHG	Thermal incinerator	5.76E+00	1.15E-01	5.65E+00	1.21E-02	2.14E-03	1.14E-03	2.02E-04
11	Tank truck rack with 1 arm handling 1 chemical; Max. through 0.00548 MMgal/yr; Avg. v.p. 0.210 mmHG	Flare	2.39E-06	4.80E-08	2.34E-06	1.60E-05	6.83E+00	6.41E-06	2.74E+00
12	Tank truck rack with 3 arms handling 1 chemical; Max. through 0.0635 MMgal/yr; Avg. v.p. 1.00 mmHG	Thermal incinerator/scrubber	6.44E-04	1.29E-05	6.31E-04	3.62E-05	5.74E-02	7.38E-06	1.17E-02
13	Tank truck rack with 1 arm handling 2 chemicals; Max. through 2.27 MMgal/yr; Avg. v.p. 703 mmHG	Flare	3.02E-04	6.04E-06	2.96E-04	5.43E-03	1.83E+01	2.17E-03	7.33E+00
14	Tank truck rack with 2 arms handling 2 chemicals; Max. through 5.68 MMgal/yr; Avg. v.p. 566 mmHG	Flare	9.92E-04	1.98E-05	9.72E-04	1.26E-02	1.30E+01	5.03E-03	5.17E+00
15	Tank truck rack with 1 arm handling 9 chemicals; Max. through 0.756 MMgal/yr; Avg. v.p. 11.9 mmHG	Thermal incinerator/scrubber	2.12E-01	4.25E-03	2.08E-01	4.01E-03	1.93E-02	1.26E-04	6.06E-04

TABLE 7. SECONDARY IMPACTS FOR INCINERATION CONTROL OF EPA MODEL LOADING RACK STREAMS

Model Rack No.	Model Description	Control Device	HAP Emissions			Secondary NOX		Secondary CO	
			Uncontrolled, Mg/yr	Controlled, Mg/yr	Reduction, Mg/yr	Emissions, Mg/yr	NOX-to-HAP Ratio	Emissions, Mg/yr	CO-to-HAP Ratio
16	Tank truck rack with 4 arms handling 10 chemicals; Max. through 7.84 MMgal/yr; Avg. v.p. 592 mmHG	Flare	2.15E-01	4.30E-03	2.11E-01	1.72E-02	8.16E-02	6.88E-03	3.27E-02
17	Tank truck rack with 2 arms handling 11 chemicals; Max. through 4.40 MMgal/yr; Avg. v.p. 659 mmHG	Flare	8.72E-01	1.74E-02	8.55E-01	9.73E-03	1.14E-02	3.89E-03	4.55E-03
18	Tank truck rack with 4 arms handling 4 chemicals; Max. through 15.3 MMgal/yr; Avg. v.p. 846 mmHG	Thermal incinerator/scrubber	4.55E+00	9.11E-02	4.46E+00	1.10E-02	2.47E-03	1.80E-03	4.04E-04
19	Tank truck rack with 2 arms handling 2 chemicals; Max. through 3.70 MMgal/yr; Avg. v.p. 128 mmHG	Thermal incinerator/scrubber	4.30E+00	8.61E-02	4.21E+00	3.80E-03	9.02E-04	5.40E-04	1.28E-04
20	Tank truck rack with 4 arms handling 4 chemicals; Max. through 30.2 MMgal/yr; Avg. v.p. 131 mmHG	Flare	1.97E+01	3.95E-01	1.93E+01	6.36E-02	3.29E-03	2.54E-02	1.32E-03

TABLE 8. SECONDARY IMPACTS FOR STREAM STRIPPER CONTROL OF EPA MODEL WASTEWATER STREAMS

Model Stream No.	Model Description			HAP Emissions		Secondary PM		Secondary SO2		Secondary NOX		Secondary CO	
	Flow, lpm/Gg/yr	HAP Conc. mg/l	Volatility	Uncontrolled, Mg/yr	Reduction, Mg/yr	Emissions, Mg/yr	PM-to-HAP Ratio	Emissions, Mg/yr	SO2-to-HAP Ratio	Emissions, Mg/yr	NOX-to-HAP Ratio	Emissions, Mg/yr	CO-to-HAP Ratio
4	0.05	10	low	0.0016	0.003	0.006	2.0	0.05	16.7	0.15	50	0.02	6.67
5	0.05	250	low	0.039	0.0073	0.006	0.82	0.05	6.85	0.15	20.5	0.02	2.74
6	0.05	5000	low	0.79	0.15	0.006	0.04	0.05	0.33	0.15	1	0.02	0.13
46	0.05	10	medium-high	0.013	0.034	0.006	0.18	0.05	1.47	0.15	4.41	0.02	0.59
47	0.05	250	medium-high	0.33	0.85	0.006	0.007	0.05	0.06	0.15	0.18	0.02	0.02
48	0.05	5000	medium-high	6.6	16.9	0.006	0.0004	0.05	0.003	0.15	0.009	0.02	0.001
67	0.05	10	high	0.036	0.13	0.006	0.046	0.05	0.38	0.15	1.15	0.02	0.15
68	0.05	250	high	0.89	3.2	0.006	0.002	0.05	0.02	0.15	0.05	0.02	0.006
69	0.05	5000	high	17.9	64.4	0.006	0.00009	0.05	0.0008	0.15	0.002	0.02	0.0003
19	250	10	low	0.016	0.0029	0.06	20.7	0.5	172	1.5	517	0.2	69.0
20	250	200	low	0.32	0.058	0.06	1.03	0.5	8.62	1.5	25.9	0.2	3.45
21	250	1600	low	2.5	0.46	0.06	0.13	0.5	1.09	1.5	3.26	0.2	0.43
61	250	10	medium-high	0.13	0.34	0.06	0.18	0.5	1.47	1.5	4.41	0.2	0.59
62	250	200	medium-high	2.6	6.8	0.06	0.009	0.5	0.07	1.5	0.22	0.2	0.03
63	250	1600	medium-high	21	54.2	0.06	0.001	0.5	0.009	1.5	0.03	0.2	0.004
82	250	10	high	0.36	1.3	0.06	0.046	0.5	0.38	1.5	1.15	0.2	0.15
83	250	200	high	7.1	25.8	0.06	0.002	0.5	0.02	1.5	0.06	0.2	0.008
84	250	1600	high	57.2	206.1	0.06	0.0003	0.5	0.002	1.5	0.007	0.2	0.0010

TABLE 9. SUMMARY OF MAJOR NEW SOURCE REVIEW APPLICABILITY CRITERIA

Criteria Pollutant/ Area Designation	Potential emission rate defining major sources in nonattainment areas, tpy	Net emissions increase defining a major modification (2) PSI, tpy NNSR, tpy		Normal NNSR Emission Offset Ratio
Carbon Monoxide				
Unclassifiable/Attainment	See Note (1)	100		
Nonattainment:				
Not Classified	100		100	1.1:1
Marginal ≤ 12.7 ppm	100		100	1.1:1
Marginal > 12.7 ppm	100		100	1.1:1
Serious	50		50	1.1:1
Nitrogen dioxide				
Unclassifiable/Attainment	See Note (1)	40		
Nonattainment	100		40	1.1:1
Ozone (as VOC or NO _x)				
Unclassifiable/Attainment	See Note (1)	40 (VOC only)		
Nonattainment:				
Marginal (3)	100		40/40	1.1:1
Moderate	100		40/40	1.15:1
Serious	50		25/25	1.2:1
Severe (4)	25		25/25	1.3:1
Extreme	10		Any net increase	1.5:1

NOTES:

- (1) Stationary sources located in attainment areas are defined as major if potential emissions of any pollutant for which an area is attainment are greater than 100 tpy for 28 listed categories (including chemical process plants) or 250 tpy for all other source categories.
- (2) PSI - Prevention of Significant Deterioration (§§2.21)
NNSR - Nonattainment new source review (40 CFR Part 51, Appendix S)
- (3) Includes areas designated as Transitional and Rural Transport, and those with Incomplete Data.
- (4) Includes Severe-15 and Severe-17 areas.

TABLE 10. SUMMARY OF REGULATORY APPLICABILITY FOR EXISTING MINOR SOURCE

Model Plant	Source Description	NOX emissions, Mg/yr (tpy)	CO emissions, Mg/yr (tpy)	Attainment Areas (PSD)		Nonattainment Areas (Emission Offset Policy)						
				NOX	CO	CO		Ozone (NOX)				
						Moderate	Serious	Marginal	Moderate	Serious	Severe	Extreme
1	100 scmm air flow, 299 ppmv VOC (hexane)	1.5 (1.7)	0.3 (0.33)									
2	1,000 scmm air flow, 116 ppmv VOC (hexane)	16 (18)	2.3 (2.6)									√
3	10,000 scmm air flow, 98 ppmv VOC (hexane)	161 (178)	26 (29)	√				√	√	√	√	√
4	100,000 scmm air flow, 96 ppmv VOC (hexane)	1610 (1780)	260 (290)	√	√	√	√	√	√	√	√	√

(√) - indicates applicability of regulations to source modification

TABLE 12. SCRUBBER WATER RATES

Model Plant	Size, scmm	Size, scfm	Water circulation rate, gpm	Make-up water rate		
				Gallons per minute	Million gallons/day	Million gallons/yr
1	100	3,531	71	7	0.01	4
2	1,000	35,315	706	71	0.10	37
3	10,000	353,147	7,063	706	1.02	371
4	100,000	3,531,467	70,629	7,063	10.17	3,712

TABLE 13. NO_x CONTROL COST-EFFECTIVENESS FOR THERMAL OXIDIZER SYSTEMS

Model Plant	Size, scmm	Baseline Thermal Oxidizer System					Thermal Oxidizer System with Low NO _x Modification				Costs Associated with NO _x Control		
		Capital Cost, \$	Operating Cost, \$/yr	Capital Charge, \$/yr	Total Annualized Cost, \$/yr	HAP cost- effectiveness, \$/Mg-yr	Capital Cost, \$	Operating Cost, \$/yr	Capital Charge, \$/yr	Total Annualized Cost, \$/yr	Incremental Annualized Cost, \$/yr	NO _x Controlled, Mg/yr	NO _x Cost- effectiveness, \$/Mg/yr
1	100	428,000	25,000	107,000	132,000	2,603	514,000	25,000	129000	154,000	22,000	1	22,300
2	1,000	1,706,000	247,000	427,000	674,000	3,405	2,047,000	247,000	512000	759,000	85,000	11	8,000
3	10,000	6,790,000	2,472,000	1,698,000	4,170,000	2,507	8,148,000	2,472,000	2037000	4,509,000	339,000	107	3,200
4	100,000	27,031,000	24,720,000	6,758,000	31,478,000	1,932	32,437,000	24,720,000	8109000	32,829,000	1,351,000	1073	1,300

APPENDIX D

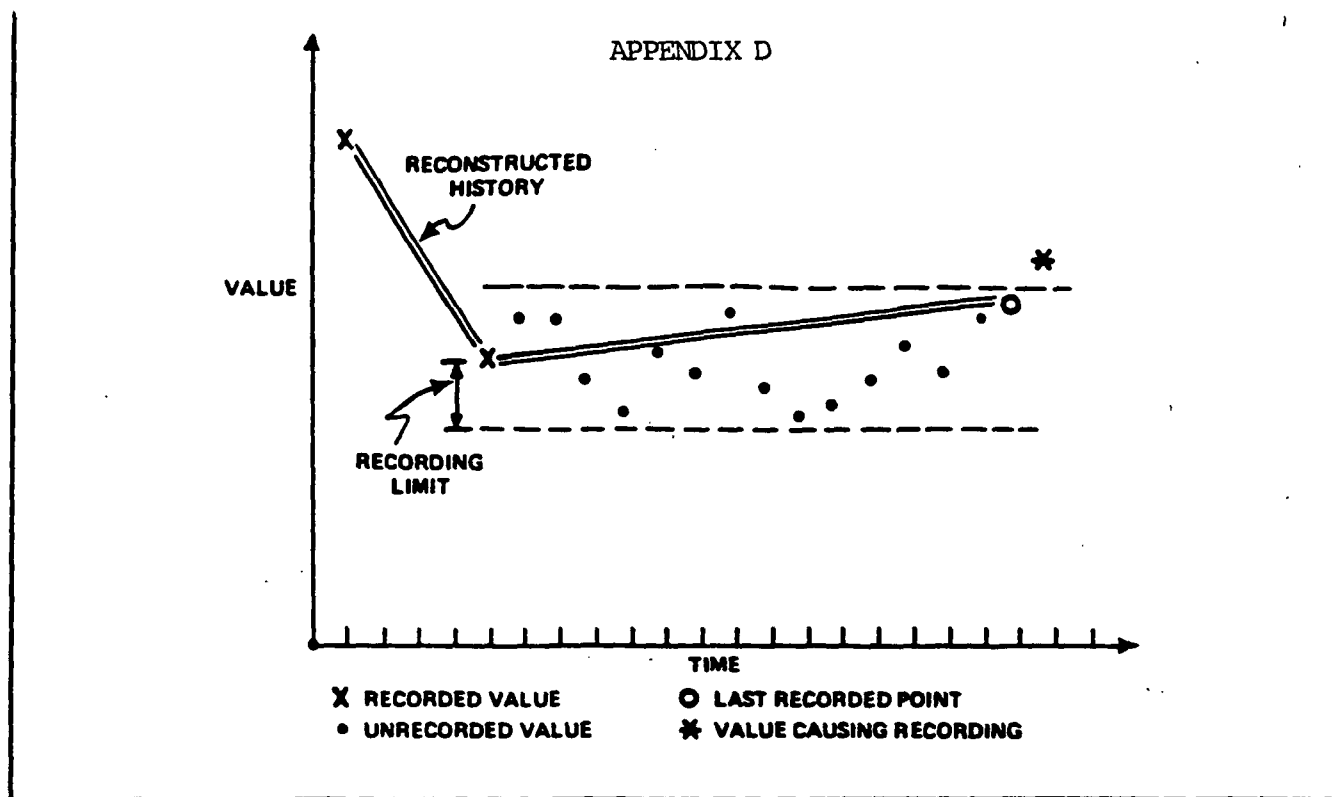


Figure 1. Box car algorithm.

Putting Computers to Work:

Historical Data Recording For Process Computers

Although process historians have demonstrated their benefits, it's often hard to convince people of how adaptable they are. Hands-on experience usually does the trick.

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Computers have been used to monitor and control chemical and refining processes for more than 15 years. During this time, there has been a steady growth in the variety and sophistication of the functions performed by these process computers. Early systems were limited to maintaining only current operating measurements, available through crude operator's consoles or noisy teletypes. The value of retaining a process history, that is, a collection of measurements over time, became apparent, and early efforts produced shift and daily summary reports. The need for improved

process historians which record, retrieve and display process information has grown as process computers assume larger responsibilities in plant operations.

Du Pont has developed process historian functions that have been used on several of its in-house process monitoring and control systems (1). This work has evolved to meet both the increasing computer capability and the demand for better availability of process information for operators and engineers. Data compression techniques have been applied to permit ever increasing data storage to remain accessible with short response times. Only significant changes are recorded, as defined for each variable, but time resolution remains as short as the basic processing cycle, typically one

minute. In this way, hundreds of variables can have their minute-to-minute variations captured with rapid recall of a month or more of history with only modest bulk storage requirements. Older data are frequently archived to magnetic tape or removable disk packs for review as required.

Process data have many users

Early approaches to process historians necessarily addressed a single requirement, e.g., a daily production or yield summary. In order to satisfy several different users with different needs, a more complex historian is required. Some examples of these users are discussed below.

Undisputedly the most important user of process data treats the historian in a way very similar to the familiar strip chart. Today his chart appears on a color graphics CRT terminal in the wink of an eye. He can arrange any set of variables of interest, confident that the plots will be accurate, synchronized in time, and that the pen won't stop inking. Operators are usually focused on only a few key process variables. The time span, which is readily adjustable, is most often set for four hours, regardless of the time constants of the process. Operators will, however, look back to periods of good operation to find clues to current difficulties.

Foremen appreciate having their own "window" or terminal access to the historian so that they won't disturb the operators. This extra console is also very valuable during start-up or emergency situations. Foremen tend to look at longer time spans, comparing their shift's operation over several days or against other crews. Production supervisors and superintendents benefit from analysis of detailed data for entire accounting periods, usually a month or more. Once record rates or yields are achieved, the complete operating conditions can be used to obtain repeat performances.

The process engineer's use of a historian's function is the most varied. At least three distinct modes can greatly

increase the engineer's efficiency: routine performance review, problem diagnosis, and process testing/debottlenecking. An engineer supporting a process must frequently review recent plant performance. With a computer-based historian, the task of scanning the dozens of variables in his area of responsibility for the previous day or weekend takes only a few minutes. Upon completion he can be confident that he did not miss anything of consequence. This review leads to problem diagnosis, a job that is often hampered by lack of information.

The flexibility of the historical display permits a time span that could vary from five minutes full screen to three months. Since the data consists of the actual events rather than averages, the time sequence of events can be seen. This, in turn, allows a much better opportunity for determining the actual cause of upsets rather than being misled by a symptom. In the third mode, the engineer performs the usual plant process and capacity studies. The test may be a designed experiment or an analysis of the process response to unplanned disturbances. In either case the historian permits him to prepare detailed data sets for statistical correlation, comparison with process simulations, or design flow sheets, etc. A major step forward from the traditional clipboard approach.

Maintenance support often requires much longer view than other users. Examples include plotting the history of a large compressor's vibration probes and bearing temperatures over a multi-month span. Catastrophic failures can thus be avoided. A similar use would monitor calculated heat transfer coefficients in all major heat exchangers on a unit, permitting the cleanout to be scheduled well in advance. Many instrument problems can also be detected in this manner, using crosplots of process and laboratory analyzers on the same streams.

Data-saving techniques

This list of users is not meant to be complete, and there are clearly reasons that others including research chemists,

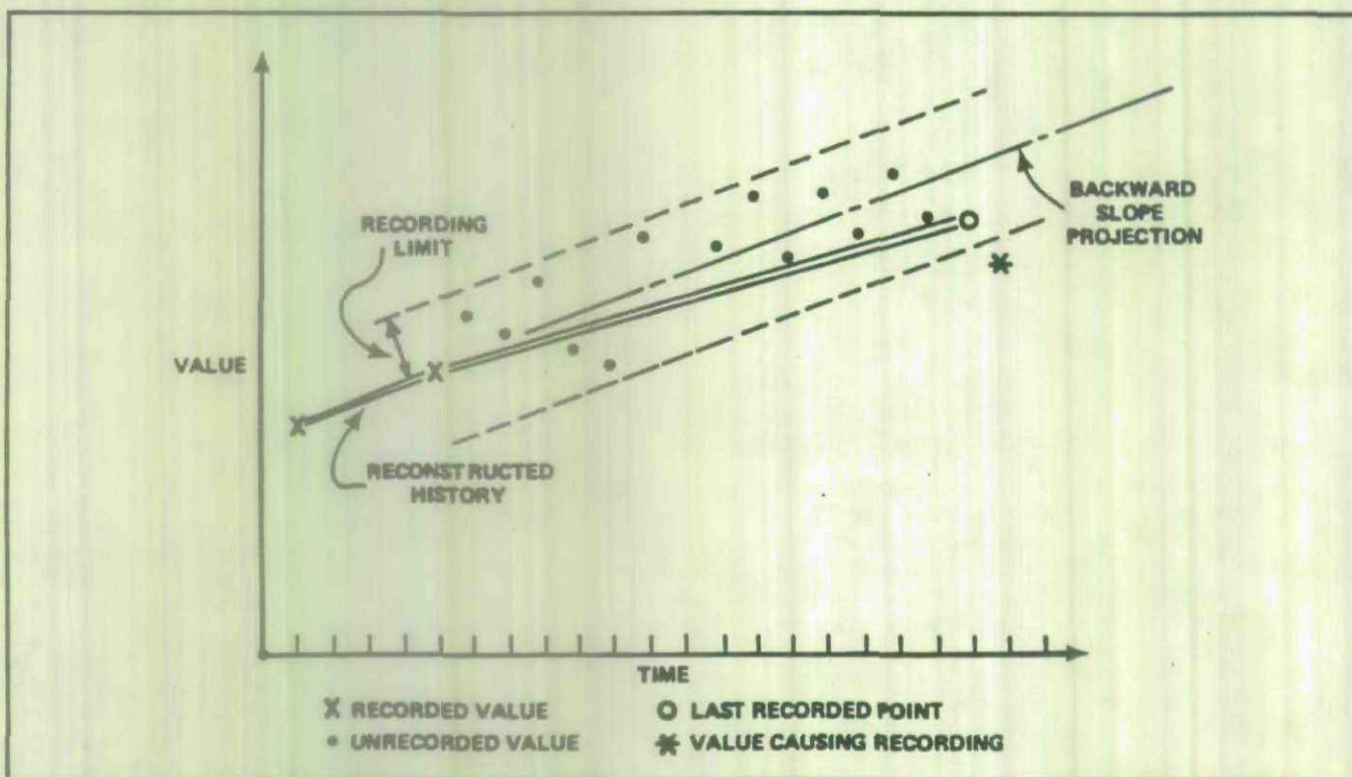


Figure 2. Backward slope algorithm.

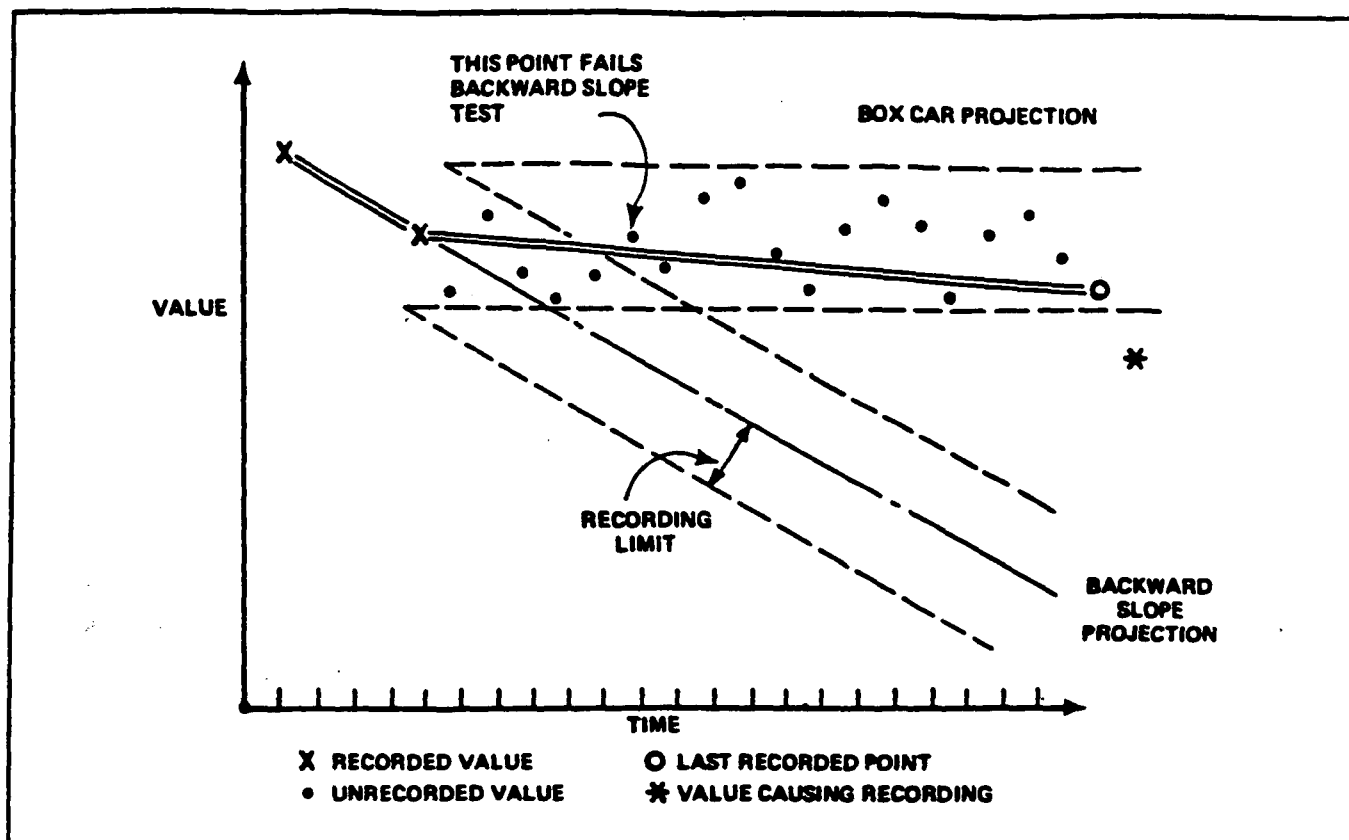


Figure 3. Combination algorithm.

marketing specialists, or design engineers need access to this process information. Present communication capabilities give the extra freedom to have some users remote from the plant site. An important benefit should be stressed; this is the improved communication among the different users. The operator now has solid proof of a process or equipment problem he went through on graveyard shift and can easily show it to the people who will have to solve it. While hard copy is available, most discussions among production, technical, and maintenance people take place around a console so that the historian can replay the problem from another angle.

The historian should be comprehensive. This means including all variables: direct measurements, derived calculations such as yield, and laboratory results. This approach assumes that if a variable is important enough to be in the computer, it should be recorded as well. Older panel board control rooms typically connected only 20 to 30% of all transducers to strip charts, primarily because of real estate limitations. No such restriction exists with modern computer hardware. In particular, the diagnosing mode demands that all the data be available. It recognizes that it is impossible to know ahead of time what information may be the vital clue. Experience with numerous troubleshooting sessions proves that seemingly unimportant transducers have been the key to major savings. This benefit frequently leads to a 20% growth in instrumentation connected to the process computer.

The parameters that determine the design of a process historian are straightforward. The volume of data will be a function of the number of variables recorded, the frequency of recording for each variable, and the total time span desired. Even for a modest-size process, this total can become a very large number. Other factors that become important are the desired retrieval and display time and the added computer load required to handle this added function. Many engineering tradeoffs are possible.

A satisfactory design for many situations involves a called snapshot approach. The total storage requirements can be significantly reduced by two routes: record only a limited subset of the total variables, say 30%; and store only 10 minute averages rather than the minute-to-minute readings. This combination would need only 5% of the space the full detail would require and could handle many accounting tasks quite well.

Computer load to store the data would be equally modest but retrieval would be slow since most of the files would be read back in and the selected variable taken out of each snapshot. Most implementations of this type permit a reselection of recorded variables with varying degrees of difficulty. Long-term storage might consist of printed log or some machine readable media such as floppy disks. For some applications, this will remain an adequate solution.

Data compression

As the requirements for the historian increase, the simpler techniques are no longer adequate. Retaining minute-by-minute readings for a month on a 1,000-variable system would require 45 million entries, more bulk storage than many process computers use for all purposes. Recognizing that there are long periods of operation in which variables are either constant or moving in a predictable path, techniques of data compression can be utilized very effectively.

Because data compression results in recording points that are no longer at equally spaced time intervals, each value must be stored with a date-time tag. For a computer, this can be done with eight bytes: four bytes for the real number value expressed in engineering units and two bytes each for integer codes of the date and time. In this case, the technique doubles the storage requirements per reading so that the data compression ratio must be greater than 2:1 to be effective. Data compression is defined as the

number of values processed at equal time intervals which resulted in single recorded value. For a system processing variables at one minute intervals, a 30:1 data compression ratio would mean that each variable was being recorded once each half hour on the average.

The data compression ratio is a crude index that reflects the overall operation of the historian. In practice, the amount of storage for each variable (an inverse function of the data compression efficiency) usually resembles a Gaussian distribution. Some variables can be characterized for a given time period with only one or two blocks of storage, e.g., lab results that are only obtained once or twice a shift. Very active variables such as flow rates often require 100-200 blocks to cover the same time. (A block corresponds to a disk sector or 512 bytes.) The majority of the variables could then follow in the range of 20 to 40 blocks.

It is not unusual for the storage requirements to change by two orders of magnitude from the most active to the most static on a single process. Not only does storage demand vary from variable to variable, it can vary significantly with the state of the process. Obviously, recording demands are heavy during start-ups or periods of upsets. Since the total memory available for historical purposes is usually fixed, this means the on-line time span contracts somewhat to reflect the temporarily decreased data compression ratios. As the plant lines out, the available time span increases again.

Use of data compression requires that two choices be made for each variable: a recording limit and an algorithm to make the recording decision. The recording limit is most often selected to match the transducer's inherent accuracy, e.g., 1% of span or 0.5°C for thermocouples. This avoids recording measurement noise but captures true process changes. In a few cases, a recording limit of zero may be used to force recording of all measurable changes.

Selecting effective algorithms

While data compression algorithms may be quite complex, such as those used in space satellite communications (2,3), several straightforward techniques produce excellent results. Three of the algorithms that are discussed below have proven themselves in several years of use. The degree of computational complexity is an engineering trade-off; the computation must be performed for each variable each time it is processed. Consequently, algorithms which achieved higher data compression ratios might not justify the additional computational load. Increasing capabilities in process computers will provide an incentive to use more sophisticated methods.

These three algorithms developed in an evolutionary manner. Early implementations used computers with very limited bulk storage, and there was a strong desire to record a time period of at least two or three days, thereby allowing review of a weekend's operation. Initial experiments with the Box Car showed it to be quite effective. The Box Car algorithm records when the current value differs from the last recorded value by an amount greater than or equal to the Recording Limit for that variable. Many processes are fortunate enough to run for long stretches of stable operation.

However, it became apparent that the Box Car did not always obtain high data compression ratios. A classic case is that of a large tank slowly filling. The Box Car algorithm will dutifully record each 1% of level, even though the entire change could be just as accurately described by a straight line connecting the start and end of the filling. Even continuous processes experience transitions from one rate to another, and, of course, batch operations are described in time as a series of ramping changes. The use of the Backward Slope demonstrated that this behavior could be accurately captured with significantly higher data compression ratios than the Box Car. (Computational

details of the algorithms are given in the Appendix). The Backward Slope uses the last two recorded values to predict the trend of the variable in the future.

In use, the Backward Slope did not always produce better results, i.e., higher data compression. Noise sometimes caused the projected slope to be meaningless. For these variables, the Box Car remained the best choice. This affirms that with noticeable noise the best estimator of the slope is zero. Having two algorithms helped, there still remained the problem of selecting which algorithm was best for a particular variable. This was difficult to know without actual observations, and it could vary for even a single variable depending on conditions. A level indication on a distillation column which is very noisy during an upset and stable otherwise is a common situation. This choice can be returned to the computer to handle on a dynamic basis for each variable individually. The result is the third algorithm, labeled the Combined Box Car and Backward Slope. It applies both criteria until both fail.

As applied in actual processes, there are several factors which influence performance. These include the type of process, the number and type of variables monitored, and, most importantly, the approach used to select algorithm types and recording limits. Someone who sets all thermocouple recording limits to 0.1°C will see little benefit from data compression. Review of several systems has shown that data compression ratios in the range of 30:1 are easily obtained and results of 80:1 to 100:1 have been realized without loss of meaningful information.

Display of historical information

Having put this much effort into recording process histories, there must be some way to access it. One of the best is by presentation on a color graphics CRT terminal. Fast response time is essential, since this information may be needed for decisions in emergency situations. Even in routine operation, it should be easy to scan through large quantities of data quickly. One property of a display screen is especially important: high resolution. Having gone to the trouble to preserve the details of variable movement, it doesn't make sense to throw it away by low resolution displays. Hard copy devices such as plotters can be useful, but the dominant method of access is by time-series plots on display screens.

The equipment and programming techniques used to provide graphics displays will vary from system to system, but some comments can be made about the man-machine interface. Access to the historian needs to be as flexible as possible. A user must be able to rapidly request the display he needs. This means control of the variables displayed, the time span and the scale for each variable plotted. In order to observe interactions, at least two variables must be plotted together and more than two can be very helpful. Four simultaneous variables is a good compromise between useful information and confusing displays. The time span must be easily changed. It is useful to "flip" through data sets with long time periods and then "zoom" in on interesting details. In the same way, expanding the scale can help define subtle shifts and take full advantage of the instrumentation's inherent accuracy.

All this flexibility can lead to a console that is difficult to use or, even worse, is ignored. Use of single pushbuttons to provide common commands, e.g., setting standard time intervals such as 1, 2, 4, and 8 hours is much simpler to use than a typed command of several characters. Similarly, preselecting groups of variables to display together is very helpful. The ability to assemble any combination is always available. In practice, operators view almost all their electronic "strip charts" with a single key stroke which can lead them quickly through a predefined view of the recent history of the process.

It is very difficult to describe this method of viewing the

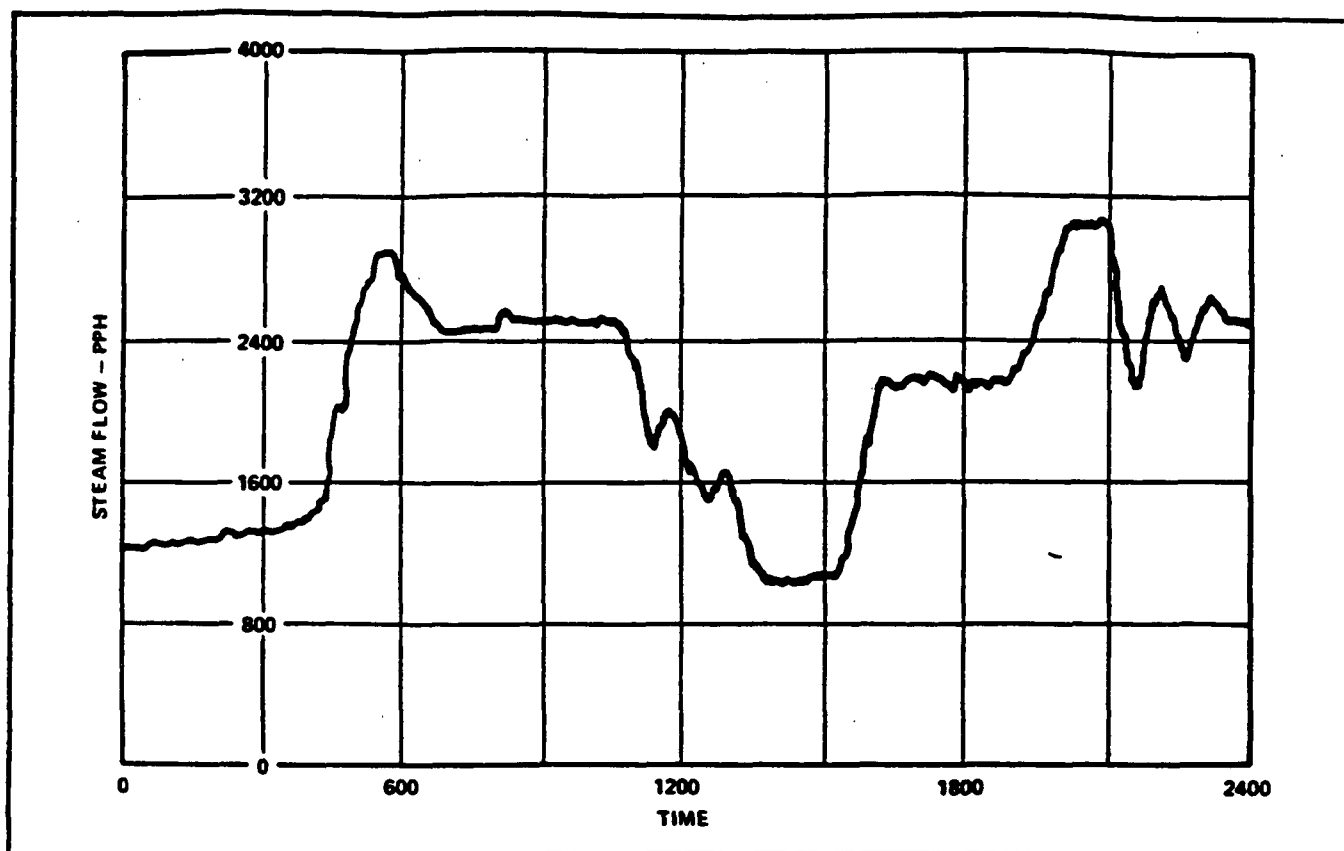


Figure 4. Steam flow rate.

process, unless you are observing the consoles. Typical displays are shown in Figures 1 to 4. The human mind has a remarkable facility for extracting key observations out of the thousands of data points displayed in this manner. Frequent use of this view of a process leads to mental models of these patterns just as operators remember dial positions of panel board instruments. Operators become conscious that "things don't look right" without going through a structured analysis. Other uses for this historical data are being developed, but visual screening by the people associated with a plant is certain to remain a very important justification.

Bulk storage management required

The historian depends on a substantial amount of fast access bulk storage, e.g., disk drives, as part of the process control system. Some features are important to the proper operation of the historian.

Typically the historical data base is organized as doubly linked, circular lists of disk blocks or sectors. Each block will contain several readings and their date/time tags, e.g., 60 pairs. Each variable has its own linked list which is found in a directory pointing to the head and tail of each linked list. History is thus sorted by variable as it is recorded. This is a major factor in fast response displays. This technique can make possible the display of a single variable's history for eight hours in 2 to 4 seconds, and a set of four variables in only 4 to 8 seconds. Very noisy variables with low compression ratios will require somewhat more time.

The data compression and sorting have a synergistic effect on response time. Assuming a 30:1 data compression ratio for a given variable, the actual storage would be 15:1 due to the date/time tag. If the data were recorded every minute, four disk transfers would be required for an eight-hour display and transmitting it the screen would consume two seconds at 9,600 baud (assuming four bytes per plotted

point). Compression would require only one or two disk transfers (averaging 1.5 because data may be shared between two blocks) and transmission time of only 0.07 seconds.

The linked list for a variable may be entered at either end. Displays most often use the most recent data and archiving functions access the oldest. Some data are entered after a delay. This feature is needed because laboratory results and other manual readings are not available in real time but are an important part of the process history. These data are time tagged with its actual sample or measurement time, not the time it was entered.

A bulk storage management function is important; this program collects and archives history for long-term storage to free up space for the new data that are being collected. It attempts to keep the maximum time period available on-line that its file size will permit. If the archiving is temporarily lost due to equipment failure, the historian will continue to operate satisfactorily by writing over the oldest data in the system. Several utility functions have been developed to repair problems such as bad disk blocks, broken links, incorrect times, etc. So far, no one has found a totally acceptable answer to the Fall change from daylight savings to standard time! Other related functions store and retrieve old data when required. When an old set is read back into the computer, it is relinked to the recent information thereby becoming accessible in the normal way. In this manner, plots of key variables can be prepared for time spans as long as a year or more.

Some tools are required to "tune" the historian. Some noisy variables may be wasting the resources of the machine without providing useful information. The top few variables which have low compression ratios should be periodically reviewed to determine if they require that volume of data to accurately reflect their movement. Changes in recording rate with respect to the rest of the variables may signal either an instrumentation failure or a process change.

In summary

The process historian has demonstrated major benefits in use over several years with varied processes. Nevertheless, it has also proven difficult to describe to potential users. There are at least two reasons for this. The first relates to the need to observe a real system in operation. The historian has the power to adapt to a wide range of users, but actual hands-on experience is needed to convince people of this fact. A second factor is the concern that a substantial data compression cannot be achieved without sacrificing the accuracy of the regenerated curves. Confidence is sometimes only achieved with actual use.

A major advantage of data compression for a process historian is that it can be the difference between making the function feasible or not. The historian's usefulness has been shown to greatly increase when all variables are recorded and the on-line storage consists of many days. This relates to the need to analyze problems, which are both complex and which are not immediately detected. Feasibility can be measured several ways. One is equipment cost, both investment and maintenance. While it is cost-effective to devote a disk drive to this function, eight or 10 drives are not realistic. Among other things, floor space adjacent to control rooms is very expensive. These cost factors carry through to other items such as storage of archival material.

Feasibility is also related to responsiveness. If information is not readily available for real time decisions, its value is greatly diminished. Response time is directly related to the reduced volume and presorted condition. Users will not request information frequently, if long delays result. Some historians plot several thousand time histories each day.

The problem analysis or troubleshooting ability has already been cited. This aspect is particularly important during startup of a new or expanded facility. The historian can greatly accelerate the "learning curve" resulting in payouts for the entire process computer system during this phase alone. In one case, 18 interlocks occurred to a reactor during its initial operation of three weeks. In every case, the true source of the interlock was detected and corrected.

It achieved excellent performance following this startup period; without a historian, the reactor would have restarted with no proven explanation of some of the interlocks. When actual problems are solved, unit utility frequently improves with accompanying safety benefits. The benefit of having all the data accurately captured cannot be overemphasized. All too often, an analysis cannot be made because too little is known about what really happened.

Our experience to date with process historians has been very encouraging. It suggests that it must be comprehensive and responsive to be fully effective. To date, we have been able to achieve significant cost savings in the installed equipment and, more importantly, obtain better process insight. We have seen that as the historian's capabilities increase, it can serve a variety of users with quite different needs, rather than the limited, dedicated approach that is often employed. Certainly there are many ways that the current technology of process computers can be expanded and enriched. We believe that process historians will become an increasingly important reason for installing a computer on a process.

Acknowledgments

Harold L. Sellars' work on the historian was done while at Biles and Assoc., Inc., Houston, Texas under the contract with E. I. du Pont de Nemours & Co., directed by John C. Hale. Randolph S. Knipp, Du Pont, supervised the initial installation. #

Literature cited

1. Crowder, R. S., *Instrumentation Techn.*, 18, 1, p. 58 (January, 1971).

2. Davison, L. D., "Data Compression Using Straight Line Interpolation," *IEEE Trans.*, It-4, No. 3, p. 390 (1968).
3. ———, "Data Compression, A Bibliography with Abstracts," *NTISearch/PS-75/860* (December, 1975).

Appendix: Data Compression Algorithms

Box Car Algorithm. This method records data when a value is significantly different from the last recorded value, Figure 1.

If $|V - V_R| \geq H$, record the previous value processed, not the current value which caused the triggering of the recording. Recording is accomplished by setting:

$$T_R = T_L$$

$$V_R = V_L$$

Backward Slope. In this case, the decision is based on a projection defined by the slope S and the last recorded value, Figure 2.

$$|V - (V_R - S(T - T_R))| \geq H$$

Recording is accomplished in the same manner as for the Box Car, and a new slope is calculated which is derived from this newly recorded point and the recorded value immediately prior to that.

Combination Box Car and Backward Slope Algorithm. This method combines the two above by using an adaptive parameter, P . P is initialized to zero and remains there as long as both of the tests are passed. If the Backward Slope test fails, P is set to one, and the method reverts to the Box Car until a recording is made. The algorithm is then reinitialized by setting P to zero. If the Box Car fails first, P is set to 2, and only the Backward Slope is used until a recording is made. If both tests are failed while P is zero, recording is performed, and P remains at zero, Figure 3.

Notation

- V - current value of variable
- V_L - last current value on previous processing cycle
- V_R - most recent recorded value
- T - current time
- T_L - time of previous processing for this variable
- T_R - time matching most recent recorded value
- H - recording limit parameter
- S - projected backward slope - $(V_L - V_R)/(T_L - T_R)$

All V 's and H 's are in standard engineering units such as °C or kg/h. The T 's are time intervals that imply a date/time identification so that time intervals of longer than a day can be accommodated. In general, H , the recording limit, is adjustable on a variable-by-variable basis.



J.C. Hale, consultant manager for on-line systems in the Engineering Dept. of E.I. Du Pont de Nemours & Co., has had a variety of assignments involving process computers. He earned his B.E. degree at Vanderbilt Univ., and his Sc.D. at the Univ. of Virginia.



H.L. Sellars, an instructor at Southwest Texas State Univ., earned his B.S. and M.S. degrees in mathematics at the Univ. of Alabama. An active industrial consultant, he specializes in computer control software, system design, and project management. He has had more than 15 years of experience in computer control of chemical and refining processes.

APPENDIX E

APPENDIX E



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

MAR 3 1992

Mr. Larry L. Thomas
President
The Society of the Plastics Industry
1275 K Street, N.W., Suite 400
Washington, D.C. 20005

Dear Mr. Thomas:

This is in response to your January 21, 1992 letter to Mr. Rosenberg requesting clarification of the definition of Polycyclic Organic Matter (POM) as listed in Title III, Section 112(b)(1), of the Clean Air Act Amendments of 1990 (CAAA).

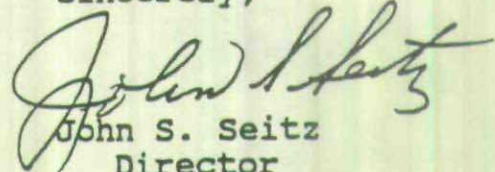
As you mentioned in your letter, historically the working definition of POM has been that complex mixture of compounds which is formed during organic combustion and pyrolysis processes. However, POM, if broadly defined in Section 112(b), could potentially include many chemicals not associated with combustion or pyrolysis such as the benzene-based polymers and plastic related compounds. Several compounds that could be classified as POM are listed individually as specific hazardous air pollutants, (i.e. 2,3,7,8-Tetrachlorodibenzo-p-dioxin). Consequently, if specific, non-combustion or non-pyrolysis chemicals meeting the current definition of POM are discovered to be hazardous air pollutants in the future, such pollutants could be individually listed rather than included in the general POM category. The intent of not characterizing individual compounds in the POM compound category is further supported by the statutory language which precludes petitions for unique chemical substances from the POM compound category. This language indicates that unique, specific, chemicals would not be identified within this mixture. For the present, the definition will remain as it appears in the CAAA. The use of this definition, however, will continue to emphasize emissions from combustion and pyrolysis activities.

We are seeking to codify the list of pollutants under Section 112b and plan to identify this issue for comment. The use of this definition, however, will continue to emphasize emissions from combustion and pyrolysis processes. As you noted in your letter, the production of plastics and the manufacture of plastic products are currently included on the source category list but not on the basis of emitting POM. They are, however, included on the source category list as emitting other pollutants listed under Section 112(b)(1).

2

If you have a specific chemical compound in mind for which you would like clarification or if you would like to discuss the interpretation of POM and the implications under the Clean Air Act of 1990, please call Dr. Nancy Pate in the Office of Air Quality Planning and Standards at 919-541-5347. The ongoing efforts of the plastics industry to recycle plastic, reduce emissions and develop environmentally sound operation management practices are appreciated and encouraged.

Sincerely,

A handwritten signature in dark ink, appearing to read "John S. Seitz", is written over the typed name.

John S. Seitz

Director

Office of Air Quality Planning
and Standards

APPENDIX F

APPENDIX F

EASTMAN

Texas Eastman Division
P.O. Box 7444
Longview, Texas 75607-7444
903.237.5000

April 13, 1993

Ms. Karen Fidler
Chemical Manufacturers Association
2501 M Street, NW
Washington, DC 20037

Dear Karen:

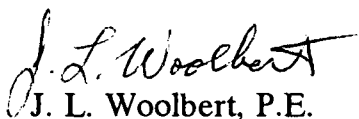
Re: Assessment of Low Flow Cutoff - Attachment for CMA Comments on
the HON

EPA's determination of a low flow concentration limit is described in docket A-90-19, item II-B-272. EPA made the determination from an evaluation of 1266 vent stream points in the HON database (the later database not available in the docket for this rulemaking). EPA determined the minimum positive flow rate in the database for any vent stream with a TRE value less than 1 as 0.005 scmm.

Not having the database to review, an alternative analysis was undertaken to assure the 0.005 scmm cutoff was not totally inconsistent with the proposed TRE equation and coefficients. The attached analysis indicates the TRE equation, when highly biased with simplifying assumptions, would categorize all flows as Group 2 for flowrates less than 0.001 scmm. In addition, the analysis agrees with the EPA analysis that the flare coefficients determine the cutoff value rather than the other coefficients.

It is concluded therefore that the 0.005 scmm cutoff is consistent with TRE equation within the accuracy of this assessment method.

Yours truly,



J. L. Woolbert, P.E.
Principal Chemical Engineer
Environmental Affairs

L010JLW3.tjb



Eastman Chemical Company
A Division of Eastman Kodak Company

Attachment 1

Analysis of Low Flow Cutoff Consistency With TRE Equation

$$TRE = \frac{1}{E_{HAP}} [a + bQ_s + cH_t + dE_{TOC}]$$

Objective: To determine EPA's flow value cutoff level of 0.005 scmm to be utilized for Group 2/non-applicability determination of the HON Process Vents provisions is consistent with TRE coefficients proposed December 31, 1993.

ANALYSIS:

Assumptions:

1. Ignore Q_s term because b is always positive (> 0) and will always bias TRE numerator toward Group 2:
2. Assume entire flow is HAP compound to bias analysis toward Group 1.
3. Assume entire flow
 - a. is TOC (i.e. $E_{TOC} = E_{HAP}$) where d coefficient is negative
 - b. is non-organic (i.e. $E_{TOC} = \text{Zero}$) where d coefficient is positive
 to bias analysis toward Group 1.
4. Assume vent stream net heating value
 - a. Maximum of $H_T =$
where c coefficient is negative, and
 - b. is $H_T = 0$
where c coefficient is positive
 to bias analysis toward Group 1.

Specific Evaluations of Reduced TRE Equation

Case I - Non-Halogenated Flare

(Existing)

$$TRE_{FLARE} = \frac{1}{E_{HAP}} [2.902 - 1.153 \times 10^{-2} H_T - 1.100 \times 10^{-3} E_{HAP}]$$

(New)

$$TRE_{FLARE} = \frac{1}{E_{HAP}} [0.5276 - 2.098 \times 10^{-3} H_T - 2.000 \times 10^{-4} E_{HAP}]$$

Case II - Non-halogenated Thermal Incinerator 0 Percent Heat Recovery

(Existing)

$$TRE_{INC,0} = \frac{1}{E_{HAP}} [2.238 - 1.739 \times 10^{-3} E_{HAP}]$$

(New)

$$TRE_{INC,0} = \frac{1}{E_{HAP}} [0.4068 - 3.162 \times 10^{-4} E_{HAP}]$$

Case III - Non-halogenated Thermal Incinerator 70 Percent Heat Recovery

(Existing)

$$TRE_{INC,70} = \frac{1}{E_{HAP}} [3.778]$$

(New)

$$TRE_{INC,70} = \frac{1}{E_{HAP}} [0.6868]$$

Case IV - Halogenated, Thermal Incinerator and Scrubber

(Existing)

$$TRE_{INC,SCRB} = \frac{1}{E_{HAP}} [5.992 - 2.653 \times 10^{-3} H_T]$$

(New)

$$TRE_{INC,SCRB} = \frac{1}{E_{HAP}} [1.0895 - 4.822 \times 10^{-4} H_T]$$

For terms with E_{HAP} in numerator, it is apparent when dividing each term by $1/E_{HAP}$, this term is a minor term when TRE is approximately 1; therefore, these terms are deleted from the equations in further analysis.

The most stringent of the above pairs of equations are the "(new)" equations as follows:

Case I

$$TRE_{FLARE} = \frac{1}{E_{HAP}} [0.5276 - 2.098 \times 10^{-3} H_T]$$

Case II

$$TRE_{INC,0} = \frac{1}{E_{HAP}} [0.4068]$$

Case III

$$TRE_{INC,70} = \frac{1}{E_{HAP}} [0.6868]$$

CASE IV

$$TRE_{INC,SCRB} = \frac{1}{E_{HAP}} [1.0895 - 4.822 \times 10^{-4} H_T]$$

Note: For given values of H_T and E_{HAP} , Case I is more stringent than Case IV and Case II is more stringent than Case III. The resulting assessment is then to determine the corresponding flows for

Case I

$$TRE_{FLARE} = \frac{1}{E_{HAP}} [0.5276 - 2.098 \times 10^{-3} H_T]$$

and Case II

$$TRE_{INC,0} = \frac{1}{E_{HAP}} [0.4068]$$

Substituting worst-case heating value (see calculation in Attachment 2) into Case I equation result in

$$\begin{aligned} TRE_{FLARE} &= \frac{1}{E_{HAP}} [0.5276 - 2.098 \times 10^{-3} \{147\}] \\ &= \frac{0.2192}{E_{HAP}} \end{aligned}$$

Therefore, for purpose of the analysis, the flare example would be expected to yield the lowest flow cutoff value to guarantee $TRE > 1$ for all vents subject to the TRE equation that were indeed ($TRE > 1$) Group 2.

At $TRE = 1$

$$\begin{aligned} E_{HAP} &= 0.2192 \text{ Kg/hour} \\ \text{and, } Q_s &= K_2 \frac{RT}{MWP} E_{HAP} \\ \text{where } K_2 &= \frac{1000g}{Kg} \times \frac{1m^3}{10^6 cm^3} \times \frac{1 \text{ HOUR}}{60 \text{ MIN.}} \end{aligned}$$

$$R = \frac{82.057 \text{ atm cm}^3}{^\circ \text{K gram-mole}}$$

$$T [=] ^\circ \text{K}$$

$$P [=] \text{ atm}$$

Thus,

$$Q_s \left[\frac{m^3}{\text{min}} \right] = \frac{(1.667 \times 10^{-5}) (82.057) (293.16) (0.2192)}{MW (1)}$$

$$Q_s = \frac{0.08790}{MW}$$

Average molecular weight of VOC mixture in Net Heating Value Calculation
 $\cong 72$.

$$Q_s = \frac{0.08790}{72} = 0.0012 \text{ m}^3/\text{min}$$

Attachment 2

Estimation of Worst-Case Net Heating Value

Procedure: Add in a cumulative sequence the net heat contribution from successively lighter hydrocarbons at saturated conditions until the sum total pressure is 1 atm. at STP (20°C).

<u>Assumed TOC Compound</u>	<u>STP at 20°C Vapor Pressure⁽¹⁾</u>	<u>Partial Pressure</u>	<u>⁽²⁾Net Heat of Combustion(KCal/mole)</u>	
			<u>TOC</u>	<u>Contribution to Mixture</u>
decane	1.30 torr.	1.30	1632.34	2.79
nonane	3.46 torr.	3.46	1474.90	6.71
octane	10.5 torr.	10.5	1317.45	18.20
heptane	33.0 torr.	33.0	1160.01	50.37
hexane	108 torr.	108	1,002.57	142.47
pentane	375 torr.	375	845.16	417.20
butane	1476 torr.	(760-531.26)	687.982	207.06
propane	6396 torr		530.605	
ethane	30918 torr.		372.820	
TOTAL:		760	TOTAL:	844.62

$$H_T = (1.740 \times 10^{-1})(844.62) = 147 \text{ MJ/SCM}^{(3)}$$

¹CRC Handbook of Chemistry and Physics, 53rd Edition, (CRC Press, Robert C. Weast, EJ., Cleveland, Ohio 44128) Pp. D-151 - .

²Net heat of combustion from Chemical Engineer's Handbook, Perry and Chilton, 5th Edition (McGraw-Hill Book Company, New York, New York) Pp. 3-145, 3-146.

³Modified equation at 57 FR 62700 by 10⁶ppm multiplication

APPENDIX G

APPENDIX G



CHEMICAL MANUFACTURERS ASSOCIATION

Ms. Sheila Milliken
Emissions Standards Division
Standards Development Branch (MD-13)
U.S. Environmental Protection Agency
Office of Air quality Planning and Standards
Research Triangle Park, NC 27711

Dear Ms. Milliken:

Thank you for the opportunity to discuss a calculation-based TRE cutoff for process vents on August 5. A copy of CMA's analysis, which we discussed, is attached. To summarize our discussion, the enclosed analysis proposes an engineering assessment of the conditions that would reasonably be expected to occur in actual operation which would result in the lowest calculated value of TRE. Using this basis, process variability was excluded from further effect in the analysis (see Handout 1 enclosed.)

Within the expected accuracy of engineering estimates, the enclosed analysis indicates that a TRE cutoff value of 3 will capture all Group 1 vents in the EPA BID draft with the exception of a single high flow, low HAP concentration vent. CMA suggests EPA may wish to consider an alternate cutoff value for this type of vent, or alternately, to exclude high flow, low HAP concentration vents from the calculation-based alternative. CMA did not suggest alternative cutoffs for this single vent in the database because one data point did not provide a sufficient database for establishing either a TRE cutoff or "high" flow/"low" concentration breakpoints.

The practical value in establishing this calculation-based cutoff is to provide relief to limited testing resources from the TRE testing determination procedure for those process vents that are obviously Group 2. The degree to which relief is provided is highly dependent on the value of the cutoff selected.

A cutoff value of 3 will provide the requisite assurance of proper Group 1 vent identification in the HON. Precedent exists in NSPS regulations for a value of four (4) [40 CFR 60.610 (c) and 60.614(f)(2)]. The enclosed rationale supports the conclusion that a value of 3 would be appropriate for the HON and is consistent with TRE cutoff values previously established by the EPA. On the other hand, a cutoff value of 8, as suggested in the pre-proposal, would significantly increase the number of Group 2 vents that would have to undergo testing and would erode the benefits of a calculation-based approach. (See Enclosure 1)

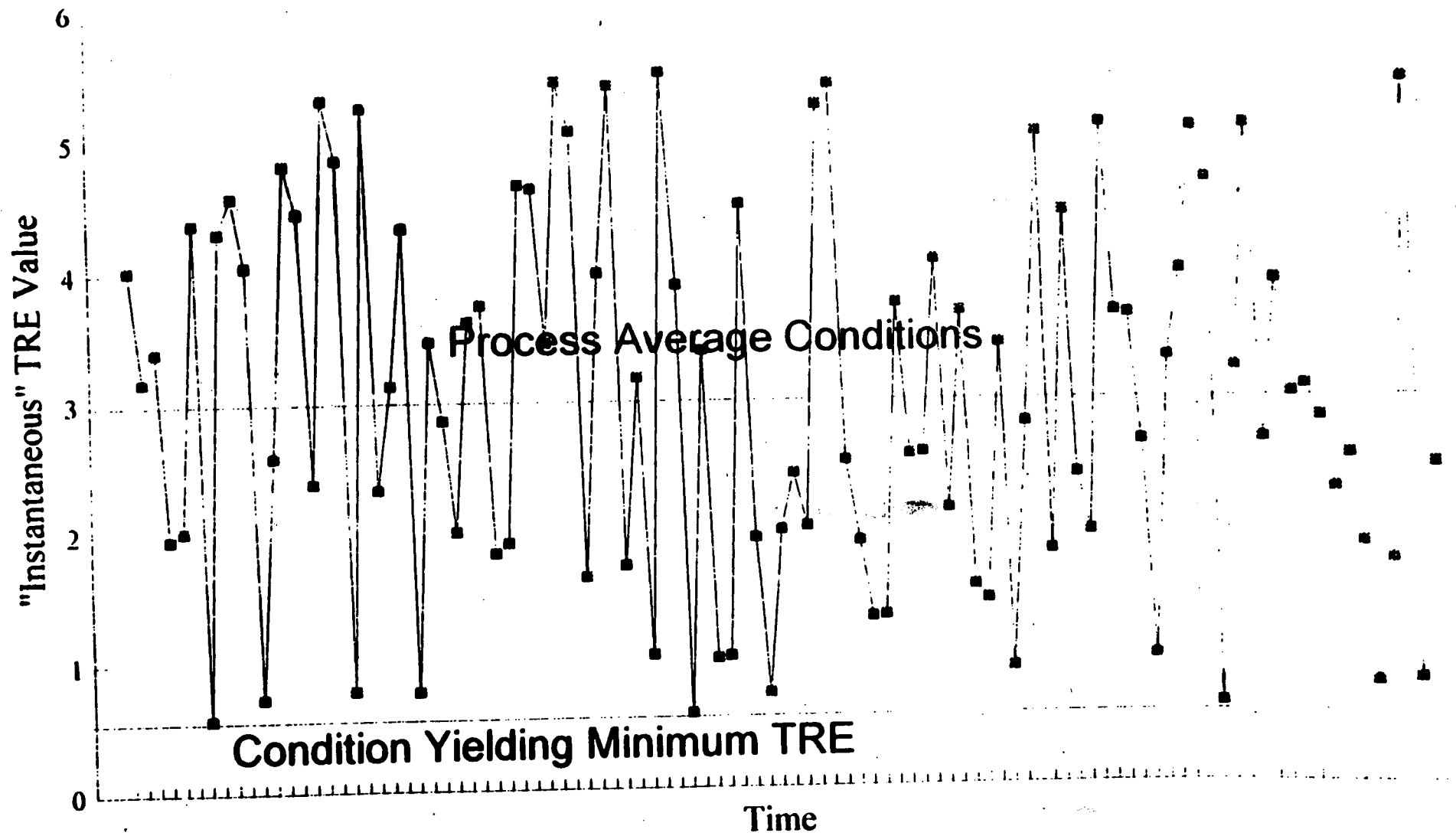
We hope this analysis is helpful in providing a scientifically defensible basis for proposing a reasonable calculation-based TRE cutoff value. If you have any questions upon review of this information, please call myself or Annette Stanley at (202) 887-1370 or (202) 887-1108 respectively.

Sincerely yours,



Amy Meyers
Manager, Air Programs

cc: L. Evans
J. Meyer
R. Rosensteel



Handout 1

Enclosure 1

X-Value Effects on Predictability of Group 2 Status for Group 2 Vents in EPA October 1991 Draft BID

Status	TRE-X=3	TRE-X=4	TRE-X=6
1. Vent expected to calculate Group 2	7	7	6
2. Vent expected to calculate false Group 1 or Group 2	10	8	5
3. Vent expected to calculate false Group 1	5	7	11
TOTAL GROUP 2 VENTS	22	22	22

Comment: This table is based on the information for the 22 non-Halogenated vents in the October 1991, Draft BID for the HON, Vol. 1C, Tables 2-2 through 2-5. It is assumed the information in the BID represents the "true" values for calculating TRE values for the vent. The status groupings above indicate, based on accuracy ranges for engineering estimates of the "true" values and a TRE cutoff value of X, whether the estimated TRE for the vent would

1. always calculate above the TRE x-value; i.e., accurately identify the Group 2 vent as Group 2.
2. calculate above or below the TRE x-value depending on where TRE input variables fall in the estimated error range; i.e., sometimes result in correct Group 2 identification but at other times result in a false Group 1 identification.
3. always calculate below the TRE x-value; i.e., always incorrectly identify the Group 2 vent as Group 1.

ANALYSIS SUPPORTING CALCULATION-BASED TRE CUTOFF FOR THE HON

Introduction

The TRE determination procedure in the December 24, 1991, pre-proposal draft of the HON §63115(b)(1) and (2) requires measurement of flow and composition of all process vents. Resource requirements and costs in time and material can be substantial for measurements at a large number of vents. While measurement may be a reasonable requirement for vents with TRE values close to the Group 1 - Group 2 breakpoint ($TRE = 1$) in the HON, such a requirement overburdens limited resources when other, less burdensome assessment methods can assure a vent is Group 2 (i.e., the vent does not require control equipment application).

Engineering estimated quantities may reliably be used to determine a vent's Group status instead of measured quantities when information from best engineering estimates predict a $TRE > 3$ and when high flow/low concentration vents are excluded from the engineering estimate option. This conclusion is derived from the accuracy that can reasonably be expected from best engineering estimates, quantified inaccuracy propagation through the TRE equation, and testing of the hypothesis with the process vent data in Volume 1C, Tables 2-2 through 2-5 of the October, 1991, draft BID for the HON. The details of this analysis are provided below.

Analysis Procedure and Basis

This analysis included the following tasks:

1. Specification of engineering estimate accuracy expectations for

TRE formula variable quantities.

2. Determination of error propagation relationship in TRE equation.
3. Calculation of TRE and Confidence Intervals for process vent data.

Specification of accuracy expectations for the variables in the TRE equation is based on best engineering judgement. The accuracy estimates and conversion formulas used in the analysis are shown in Table 1.

Variable accuracy is estimated on three separate bases corresponding to three ranges of the variable scale. The first range is the "high" variable range in which inaccuracies would be expected to be observable and easily judged from process experience. In this range, accuracies of engineering estimates should be within a fraction of the variable value. The second range is the "intermediate" variable range in which accuracies of engineering estimates should be within a few multiples of the variable value before inaccuracies would be expected to be observable from process experience. The third range is the "low" variable range in which accuracies of engineering estimates may only be within order(s) of magnitude of the actual variable value. In this range, inaccuracies in variable quantities may not be observable from process parameters.

The error propagation equation is derived in Appendix A. This analysis assumes the engineering estimates of the variable values are independent; e.g., estimating the values of E_{HAP} and E_{TOC} are done independently such that method inaccuracy in the estimate of one value is not also incorporated in the estimate of the other value. If engineering estimates of the variables are based on common base data or assumptions (e.g., E_{HAP} and E_{TOC} calculated

Table 1

Best Engineering Judgement of Engineering Estimate Accuracy ⁽¹⁾			
TRE Variable	Related Estimate Variable	Key Estimate Variable Range	Accuracy Expectation in Range
$E_{HAP}^{(2)}$	HAP Concentration	25 - 100% 1 - 25% < 1%	± 10% of Estimated Value ± 2% Composition ± 1 order of Magnitude of Estimated Value
$E_{TOC}^{(3)}$	TOC Concentration	25 - 100% 1 - 25% < 1%	± 10% of Estimated Value ± 2% Composition ± 1 Order of Magnitude of Estimated Value
H_T	H_T (BTU/SCF)	10 - Full Range > 0 - 10 0	± 200% of Estimated Value ± 1 Order of magnitude of Estimated Value + 10 BTU/SCF
Q_s	Q_s (scfm)	> 100 1 - 100 < 1	± 20% of Estimated Value ± 10 scfm ± 1 Order of Magnitude of Estimated Value

Notes:

(1) Estimate Accuracy defined as 95% confidence (3σ) Boundaries of Estimated Quantities

(2) E_{HAP} Error Estimated from Equation

$$E_{HAP \text{ ERROR}} = E_{HAP, \text{ Expected}} \times \frac{HAP \text{ Concentration, ERROR}}{HAP \text{ Concentration, Expected}}$$

(3) E_{TOC} Error Estimated from Equation

$$E_{TOC, \text{ ERROR}} = E_{TOC, \text{ EXPECTED}} \times \frac{TOC \text{ Concentration, Error}}{TOC \text{ Concentration, Expected}}$$

from common vapor liquid equilibrium data and H_T and Q , derived from VLE analysis), covariances of the variable quantities become important factors in the variance analysis. In general, positive covariances add to the magnitude of TRE variability while negative covariances will reduce this magnitude. Because of the significant additional complexity added by consideration of covariance, this analysis alternately treats the TRE variable estimates as independent and assigns large inaccuracy to the single variable estimates. Where process knowledge is utilized to estimate parameter bounds, it is believed substantial independence among the variable estimates is achieved; e.g., Q , estimated from volume displacement parameters of the process, visible plume velocity, or pressure drop calculation; H_T estimated from inert concentration, "typical component" content and "typical component" heat of combustion; E_{TOC} estimated as concentration at pressure and temperature conditions less inert concentration; and E_{HAP} calculated from VLE data and process conditions for specific HAP components.

The confidence interval of TRE estimates was calculated for the vents and model vents in Volume 1C, Tables 2-2 through 2-5 of the October, 1991 draft BID. Coefficients utilized in the TRE Equation were those for Existing Vent Streams, Table 1, Page 370 of the December 24, 1991, draft of the HON. Bases and intermediate calculations are included in Attachment B. Based on additional information provided by EPA, a distinction is made between halogenated and non-halogenated vents.

Analysis Results and Discussions

The results of the TRE confidence interval calculations are shown in Tables 2 and 4. Supporting information are shown in Tables in Appendix B.

Group 1 Vent Analyses

a. Halogenated Vents

Based on information provided by EPA, the draft BID vent database (Tables 2-2 through 2-5) contained three (3) Group 1 Halogenated Vents. Information provided in the BID only allowed variance estimation for one vent as shown in Table 2. This single vent would have a maximum calculated TRE of 1.42 with the variable accuracy parameters shown in Table 1. Therefore, with a calculation based TRE cut-off approach, capture of all halogenated Group 1 vents will occur with a calculated TRE ≤ 1.5 .

b. Non-halogenated Vents

The distribution of TRE range maxima for Non-halogenated Group 1 vents in the BID database is shown in Figure 1. All but one of these vents would have calculated TRE values less than or equal to 3 with the variable accuracy parameters shown in Table 1.

Categorical Analysis of the non-halogenated Group 1 vent with calculated TRE maxima greater than 3 is shown in Table 3. Capture of all non-halogenated Group 1 vents under a calculation based TRE cut-off approach is achievable with the following specification.

Table 2
TRE Confidence Intervals
Group 1 Vents

HALOGENATED

Table No.	Product	TRE	TRE Min Est	TRE Max Est
2-4	Vinylidene Chloride	0.1282		
2-5	Dehydrohalogenation	0.2558		
2-3	Chlorobenzene	0.4214	-0.5791	1.4219

NON-HALOGENATED

Table No.	Product	TRE	TRE Min Est	TRE Max Est
2-3	Methyl Methacrylate	0.0062	-0.9940	1.0063
2-3	Dimethyl Terephthalate	0.0340	-0.9973	1.0653
2-2	Ethylene Oxide	0.0635	-1.2010	1.3279
2-2	Acrylonitrile	0.1829	-0.8220	1.1878
2-2	Maleic Anhydride	0.0751	-0.9967	1.1168
2-5	Air Oxidation	0.1075	-1.3188	1.5337
2-5	Distillation V	0.0649	-0.9356	1.0654
2-3	Acetic Acid	0.0685	-0.9316	1.0687
2-2	Phthalic Anhydride	0.1059	-0.8949	1.1067
2-3	Butadiene	0.0753	-1.0018	1.1523
2-4	Styrene	0.1084	-0.9002	1.1170
2-3	Methanol	0.0999	-0.9601	1.1600
2-2	Formaldehyde	0.1347	-1.4088	1.6781
2-4	Nitrobenzene	0.1350	-0.8884	1.1584
2-3	Vinyl Acetate	0.1377	-0.8822	1.1576
2-5	Distillation NV	0.1623	-0.8998	1.2244
2-3	Cyclohexanone/cyclohexane	0.1872	-0.8912	1.1873
2-4	Ethylbenzene	0.2263	-0.8214	1.2740
2-5	Dehydrogenation	0.2405	-0.8321	1.3130
2-5	Nitration	0.3093	-0.7033	1.3220
2-3	Methyl Ethyl Ketone	0.3865	-1.5315	2.3046
2-3	Ethyl Acrylate	0.4468	-0.9820	1.8777
2-2	Acetaldehyde	0.5417	-18.9471	20.0305
2-4	Ethylene Glycol Mono	0.6281	-0.4405	1.6966
2-3	Ethylacetate	0.0647	-1.6928	3.0022

FIGURE 1
Distribution of TRE Confidence
Interval Maxima - Group 1 Vents

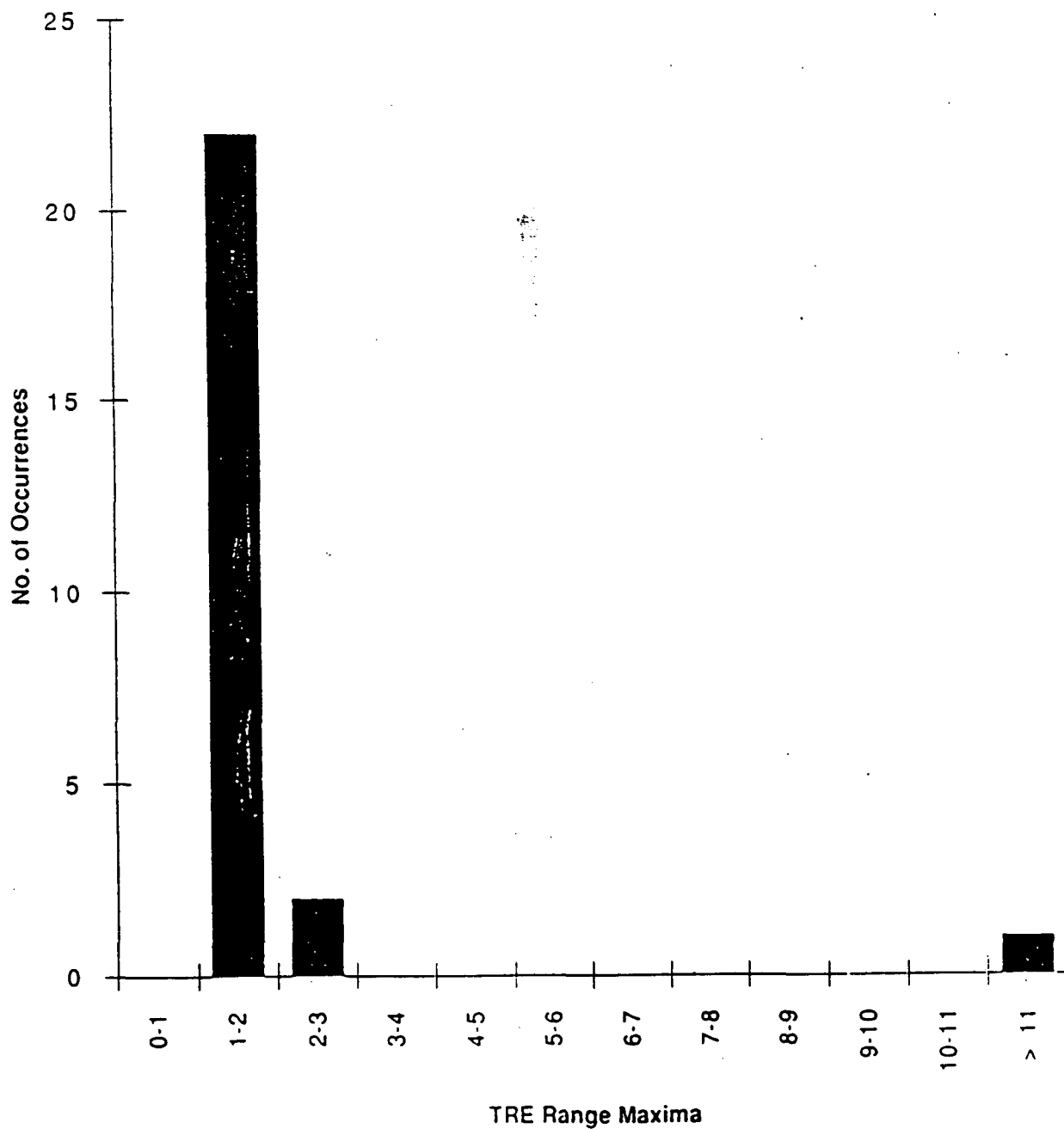


Table 3

Process Product	TRE Max	Flow ⁽¹⁾	Composition ⁽²⁾	Heat Content ⁽³⁾
Acetaldehyde	20	H	L	L

Notes:

- (1) H = High Value; scfm > 100
M = Mid Value; 1 < scfm < 100
L = Low Value; scfm < 1
- (2) H = High Value; % HAP, TOC > 25
M = Mid Value; 1 < HAP, TOC < 25
L = Low Value; HAP, TOC < 1
- (3) H = High Value; BTU/ft³ > 200
M = Mid Value; 10 < BTU/ft³ < 200
L = Low Value; BTU/ft³ < 10

1. Require sampling on process vents with "high" flow rates and with "low" HAP and TOC compositions or establish an alternate TRE cutoff for such vents.
2. Require sampling on process vents with engineering-based TRE estimates less than or equal to 3.

Group 2 Vent Analyses

Given the above outlined constraints required to assure accurate classification of all Group 1 vents through engineering estimate methods, the next consideration is the effects of these constraints on Group 2 vents.

a. Halogenated Vents

Table 4 shows the halogenated Group 2 vent population from vents listed in the draft BID. Out of 7 total halogenated Group 2 vents, the minimum expected TRE values are greater than 1.5 for three (3) vents; for these vents, engineering estimates alone would suffice to correctly identify the vents as Group 2. The remaining four (4) vents would be variously categorized as Group 1 or Group 2 based on the estimated TRE value. Where the TRE estimate is less than 1.5, a false Group 1 indication would have to be confirmed with actual testing. A tabular summary of this information is shown in Table 5.

b. Non-halogenated Vents

Table 4 shows the Non-halogenated Group 2 vent population from vents listed in the draft BID. Out of 22 total Non-halogenated Group 2 vents, the minimum expected TRE values are greater than 3 for 7 vents; for these vents, engineering estimates alone would suffice to correctly identify the vents as Group 2. An additional 5 have maximum expected TRE values less than 3; engineering estimates would incorrectly identify these vents as members of the Group 1 category 100% of the time. Subsequent testing would be required to demonstrate their appropriate classification as Group 2 vents. The remaining 10 vents would be variously categorized as Group 1 or Group 2 based on the estimated TRE value. Where the

Table 1
TRE Confidence Intervals
Group 2 Vents

HALOGENATED

Table No.	Product	TRE	TRE Min Est	TRE Max Est
2-4	Chlorobenzene	1.5988	0.5988	2.5988
2-5	Oxyhalogenation	1.7435	0.7296	2.7574
2-4	Methyl Chloride	2.5018	1.4387	3.5149
2-4	Ethylene Dichloride	2.2152	1.1924	3.2380
2-3	Perchloroethylene	6.2867	5.2867	7.2867
2-5	Halogenation	3.9161	2.8956	4.9366
2-5	Hydrohalogenation	9.1758	7.4017	10.9499

NON-HALOGENATED

Table No.	Product	TRE	TRE Min Est	TRE Max Est
2-2	Terephthalic Acid	1.1167	-46.1814	48.4149
2-5	Hydrogenation	1.1876	-3.4747	5.8498
2-4	Benzene	1.2863	0.2302	2.3423
2-5	Catalytic Reforming	1.2863	0.2302	2.3423
2-3	Nitrobenzene	1.3593	0.0786	2.6400
2-5	Hydrodimerization	1.3844	0.1921	2.5767
2-4	Adiponitrile	1.3844	0.1921	2.5767
2-5	Esterification	1.4752	-0.3922	3.3426
2-5	Alkylation	1.9340	-1.2440	5.1121
2-5	Condensation	2.2145	-0.4395	4.8686
2-3	Terephthalic Acid	2.2463	0.6622	3.8304
2-5	Generic Reaction	2.4933	0.6926	4.2940
2-3	Aniline	3.3393	-57.6589	64.3374
2-5	Hydroformylation	3.8910	-1.9204	9.7020
2-3	Ethylbenzene	7.4024	-1.6545	16.4594
2-5	Oxidation	7.5892	5.8456	9.3327
2-5	Hydrolysis	21.9082	20.4278	23.3886
2-3	Formaldehyde	26.3569	24.7730	27.9408
2-4	Dinitrotoluene	36.7389	61.7582	11.7196
2-5	Sulfonation	41.3092	30.2571	52.3614
2-4	Vinyl Acetate	49.6944	28.7001	70.6886
2-5	Oxyacetylation	49.6944	28.7001	70.6886

TRE estimate is less than 3, a false Group 1 indication would have to be confirmed with actual testing. A tabular summary of this information is shown in Table 5.

Recommendations

An engineering estimate based TRE cut-off is a viable alternative to performance testing, with a TRE-cutoff equal to 3 for non-halogenated vents excuding high flow/low concentration vents and equal to 1.5 for halogenated vents.